IN2 Series

Mass Flow Controllers and Meters

User Guide

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CELERITY.

1.0 ABOUT THE IN2

IN2 Mass Flow Controller

1.1 IN2 DIGITAL MASS FLOW CONTROLLER

The IN2 Mass Flow Controller (MFC) is an advanced digital mass flow controller which expands the attributes of the Celerity first generation IN product line. Using its analog communications protocol and pin-to-pin compatibility with earlier controllers from Celerity and other manufacturers, the IN2 MFC can retrofit into many existing systems. In addition, the digital communications protocol allows the IN2 MFC pre-programming or on tool programming of up to eight different gases and/or flow ranges. This capability enables the IN2 MFC to replace several single-gas controllers, thereby reducing inventory costs and management expenses.

In addition to simplifying inventory and procurement, the IN2 MFC offers several benefits:

- High flow rate ($\leq$ 100 slpm N_2 equivalent)
- Accepts three communication protocols:
  - Zero to 5V DC Analog
  - RS-485 Digital
  - DeviceNet™
- Easy installation
- Software level access control
- On tool user configurability
- Real-time diagnostics (e.g., valve current, base resistance output) that provides communication to the IN2 MFC without interruption of tool communications
- Small footprint
- Diaphragm-sealed solenoid valve
- Wide operating range (1 sccm to $\leq$100 slpm)
- Standard 5 R_a surface finish
- Reduced moisture retention
- Increased corrosion resistance with its Hastelloy® sensor
- Improved drydown time
- Enhanced process cleanliness
- Minimized dead volume
- Expanded support for all major surface-mount types.
- Decreased cost of ownership.

1.2 SPECIFICATIONS.

Table 1: SPECIFICATIONS

Full Scale (F.S.) Flow (N_2 equivalent)	≤30 slpm	30 to 100 slpm[1]
PERFORMANCE		
Turndown Ratio	50:1	
Response/Setting Time	1 sec. (typical)	<2.5 sec.
Accuracy (analog mode)	±(0.25% SP + 0.50% F.S.)	±(1% SP + 0.50% F.S.)
Accuracy (digital mode)	±(0.25% SP + 0.35% F.S.)	±(1% SP + 0.35% F.S.)
Linearity	±0.50% F.S. Max.	±0.75% F.S Max.
Repeatability	±0.15% F.S. Max.	
Ambient Temperature Coefficient	±0.05% F.S. per °C Max. (zero and span)	TBD
Inlet Pressure Coefficient	±0.007% F.S. per psi (0.10% bar) with autozero disabled	TBD
Electrical		
Input Voltage Requirement	Analog: ±15V DC (±20%) DeviceNet: +11 to 25V DC	
Power Supply Sensitivity	±0.05% F.S. Max.	
Power Consumption	Analog: 3 watts Maximum DeviceNet: 5 watts Maximum	Analog: 7 watts Maximum DeviceNet: 8 watts Maximum
Analog I/O Signal	0 to 5V DC	
Digital Communications	RS-485 (standard) DeviceNet (optional)	
Mechanical		
Control valve Type	Normally CLOSED (NC) or normally OPEN (NO) solenoid valve, diaphragm isolated	
Materials Exposed to Process Gas	316L VIM/VAR Stainless steel, Sapphire, Ruby, Hastelloy C-22® Inconel®	316L VIM/VAR Stainless steel, 316L Stainless steel, Nickel 200, Sapphire, Inconel
Leak Integrity (external)	<1 x 10^{-10} atm.cc/sec.	
Valve Leak through[2]	Normally Closed <1% Full Scale	
Surface Finish	5µin Ra	
Environmental		
Operating Temperature Range (ambient and gas)	0 to 50°C	
Humidity	10 to 95% RH non-condensing	
Maximum Over-range Pressure	140 psig (9.5 bar)	
Differential Pressure	7-40 psid (≤ 11 slpm) 15-40 psid (>11-30 slpm)	30-50 psid
Certifications		
DeviceNet	Meets SEMI E54 and ODVA SEMI SIG MFC profile.	
CE Mark	Meets EC Directive 89/336 EEC (Electromagnetic Compatibility): 73/23 EEC (Low Voltage)	

[1] Specifications for flow rates between 30 slpm and 100 slpm are tentative pending final qualification.

[2] Valve leak-through for normally open IN2s ≤2% Full Scale

1.3 SAFETY FEATURES

The IN2 MFC is equipped with several safety features. Understanding how these features work BEFORE a problem or incident occurs will help to bring the system back on-line quickly and efficiently.

These safety features include:

- Reverse power supply polarity protection

  Diodes in positive and negative 15V supply lines prevent reverse polarity from reaching IN2 MFC circuits; the same is true for Analog and DeviceNet IN2.

- Output over-voltage and short circuit protection

  Analog: There is no protection for power supply over-voltage. However, signal Input/Output pins are protected for over-voltage and short circuits.

  DeviceNet: The power supply can withstand +35V (nominal 11-25V supply). However, operation is not rated for supply voltages over 25V or less than 11V.

  DeviceNet IN2 with Analog Output: For systems that require both a DeviceNet and Analog output signal, the “Hybrid” IN2 MFC provides an additional analog signal. This analog signal can be connected to an independent safety monitor to ensure that critical gas flows are within the desired range. This additional analog signal is a zero to five volt signal representing the indicated flow, where five volts represents 100% flow.

- Electrical valve circuit command override

  Use the following connections to override the valve control circuitry.

Table 2: VALVE POSITION VOLTAGES

Connector	Normal Valve Position	Voltage	Apply to	New Valve Position
15-pin	CLOSED	OV DC +5V DC	Pin 13 Pin 13	OPEN NORMAL
15-pin	CLOSED	OV DC +5V DC	Pin 15 Pin 15	CLOSED NORMAL
15-pin	OPEN	OV DC +5V DC	Pin 13 Pin 13	OPEN NORMAL
15-pin	OPEN	OV DC +5V DC	Pin 15 Pin 15	CLOSED NORMAL

- Mechanical valve circuit command override

  It is not possible to operate the valve mechanically. Valve control can only be done electrically.

- Fail-Safe mode

  In the event of a power failure, a normally closed valve will **CLOSE** and a normally open valve will **OPEN**.

1.4 PRECAUTIONS

Table 3: PRECAUTIONS

	⚠ CAUTION ⚠ ***The precautions listed below apply to the installation, operation, maintenance, and repair of the IN2 MFC. Read this section carefully before performing any of these activities.***
Contamination Issues	Remove the end caps under clean room conditions only. Failure to do so may result in particulate contamination affecting the calibration and/or operation of your IN2 MFC.
Leak Check	ALWAYS conduct a thorough leak check EVERY TIME the system is opened for component installation, maintenance, repair, or replacement.
Plumbing	Use pre-cleaned or ultra-clean tubing that is free of particulate contamination.
Power Correction	NEVER insert or remove the interconnect cable unless the power is OFF. Failure to comply may result in a hazardous situation for component installation.
Purging	Use only clean, moisture-free (dry) gases DO NOT use inert gas to purge a reactive gas system UNLESS the inert gas is specified by the process AND approved by the system manufacturer.
Gas Shut-Off	ALWAYS send a “No Flow” signal to the IN2 MFC when the gas supply is cut off. If sending a “No Flow” signal is NOT possible, ground Pin 15. Interlock the “No Flow” signal with a series shut-off valve to avoid overheating the control valve when the system is shut down and to avoid flow surges when the system is restarted.
Installation Issues	Observe direction of gas flow and align the arrow on front of the IN2 with the flow direction. Avoid installing the IN2 MFC close to a source of vibration or radio frequency (RF) noise. If it is impossible to avoid these factors, use proven methods of shock mounting and/or instrumentation filtering and cable shielding. Avoid over tightening the IN2 connections. Consult local procedures, connector and seal manufacture directives, or call Celerity for proper torque of connections and screws. For VCR connection, use two wrenches when installing the IN2 MFC into the gas system. Do NOT use the cover for gripping or leverage in any way. Always use new gaskets. Failure to observe this caution may result in damage to the IN2 MFC. For Surface Mounting, observe direction of gas flow and align the arrow on front of the IN2 with the flow direction. Always use new C-Seals or W-Seals. Never use W-Seals on a C-Seal IN2; likewise, never try to use C-Seals on W-Seal IN2s. Failure to observe these cautions will result in damage to the IN2 and could cause dangerous gas leakage.

1.5 RATTLING NOISE CONFIRMATION

The IN2 MFC may rattle prior to installation. This is normal and is not a cause for concern. The IN2 MFC is equipped with a low-friction solenoid plunger which controls the valve assembly. In a no-load condition, the solenoid moves freely on a horizontal plane. If the IN2 MFC is jostled or shaken, the solenoid may make an audible sound when it reaches the end of its stroke.

1.6 CALIBRATION WARRANTY

Celerity, Inc. guarantees the IN2’s factory calibration for the period of 15 months from the date of manufacture. This warranty is based on the given specifications, normal operation of the unit and adherence to proper care and zeroing. Consult Celerity Technical Service for proper steps to take if device fails to maintain the factory calibration.

2.0 INSTALLATION PROCEDURES

NOTE: Prior to installing the IN2 MFC, complete the first three steps in the nine step installation process. Steps 1 – 3 should be completed to help ensure a successful installation and subsequent trouble-free operation.

Installation of the IN2 is accomplished in the following steps. The following steps deal only with the physical installation of the IN2. Installation of the User Software is found in “USER SOFTWARE INSTALLATION” on page 20

2.1 VERIFY PRODUCT SPECIFICATIONS

Each IN2 MFC is designed to meet specific performance specifications. **BEFORE INSTALLING** the IN2 MFC on the system, confirm that it matches the system requirements. Use the following procedure to identify and verify the IN2’s specifications.

NOTE: This information is based only for labeling done by Celerity. top labels can be user configurable and may vary from customer to customer.

a The back label of the unit shows calibration gas and range. The top label shows the specific programmed gas and range.

b. The model number is found on the back label. Reading the model number from left to right, the numbers and letters identify the IN2 MFC’s specific characteristics and capabilities.

c. To assist in identifying and documenting the IN2 MFC, copy the 8-digit model number from the back of the IN2 and enter the information into the blocks of Figure 2.

d. An explanation of each model number character is provided in Figure 4. Beginning with Position One, write into the boxes provided in Figure 3, the letter or number that corresponds to the model number character that should identify the IN2 to be used in the system. If unsure about what the IN2 specifications should be, consult local engineering or call a local Celerity Customer Service Representative (phone number are listed in back of this manual.)

e. If the characters match, proceed with the installation procedures in Step 2.

⚠ CAUTION ⚠
DO NOT proceed with installation if the characters do not match. obtain the proper IN2 with the needed specifications before proceeding with the installation.

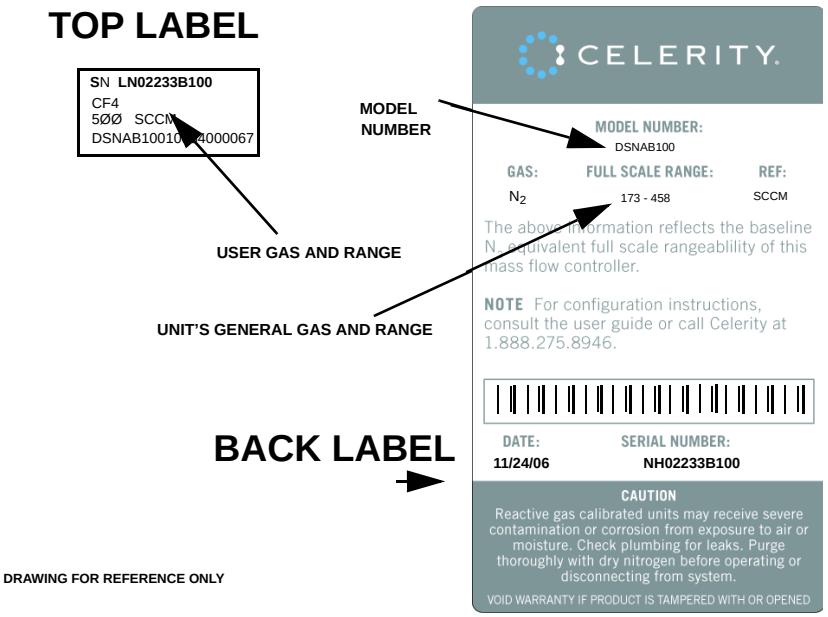


Figure 1: IN2 MFC Top and Back Label Example

WRITE THE IN2 MODEL NUMBER HERE

POSITION	1	2	3	4	5	6	7	8

Figure 2: IN2's Model Number

WRITE THE IN2 REQUIRED MODEL NUMBER HERE

POSITION	1	2	3	4	5	6	7	8

Figure 3: System Required Model Number

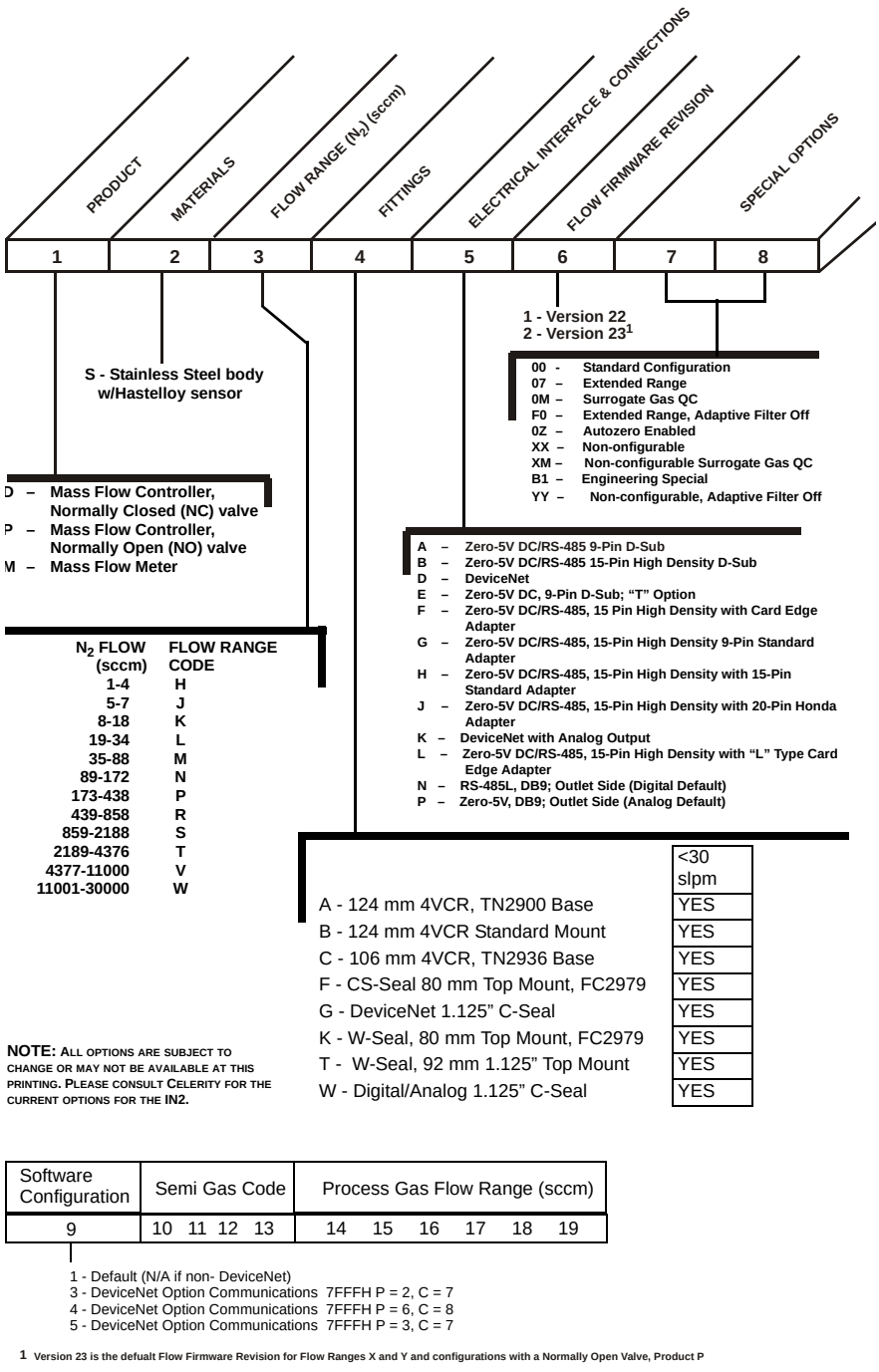


Figure 4: IN2 MFC Configurator

NOTE: The IN2 is always calibrated with N_2 unless a special gas was requested in Options.

Review the data written in the boxes. If the specifications of the IN2 MFC **DOES NOT EXACTLY MATCH** the requirements of the system, there may need to reset the Primary Calibration Gas; rewire the electrical connector to provide the correct pin type and/or signal configuration (see Appendix A); or obtain another IN2 MFC with the proper specifications.

2.1.1 DeviceNet Use

If the IN2 is configured for DeviceNet interface, (see Figure 4, IN2 MFC, Position 5, “D”) refer to position number nine of the Part Number located on the Top Label of the IN2 (See Figure 1). The appropriate number for the IN2 should match one of the following:

- 1– Default (NA if non-DeviceNet)
- 3– DeviceNet Option Communications 7FFFH P=2, C=7
- 4– DeviceNet Option Communications 7FFFH P=6, C=8
- 5– DeviceNet Option Communications 7FFFH P=3, C=7

Unless ALL of the specifications EXACTLY match your system’s requirements, the IN2 MFC you are about to install MAY NOT FUNCTION PROPERLY IN YOUR SYSTEM.

Celerity will NOT be responsible for replacing or repairing an IN2 MFC that was installed in a system for which it was not properly configured.

If the specifications of your system and the IN2 MFC you are about to install do not match, refer to your tool’s installation manual before proceeding with the installation. If the specifications do match, go to Step 2.

For further assistance contact your Celerity representative.

2.2 VERIFY PRE-INSTALLATION INFORMATION

The IN2 MFC is double-packed in a Class 100 cleanroom environment to protect it from contamination. To prevent contamination during installation:

- Keep the IN2 MFC in its sealed package
- Keep the protective caps on the ends of the IN2 MFC.
- Do not remove the IN2 MFC protective package until ready to make the connections that will add the IN2 MFC to the system.

NOTE: The IN2 MFC matches standard industry specifications and can replace existing unit of fit in a system that has been plumbed to standard industry specifications. No plumbing modifications should be required to install the IN2 MFC. Gaskets, seals, connectors, and screws are not furnished with the IN2 but must be present for installation. Use ONLY APPROVED NEW SEALS AND GASKETS OF THE PROPER KIND.

2.3 CONFIGURE THE IN2 FOR A NEW GAS OR FLOW RATE

Configuring a new gas and/or range can be accomplished on tool or off tool. An explanation of the procedure is found in “Configure Gas or Range” on page 26.

2.4 PREPARE THE INSTALLATION ENVIRONMENT

NOTE: The following guidelines will enhance safety and minimize system downtime. They augment, but do not replace, existing system modification procedures. Check with facility and health safety department for approval to take the System off-line and to confirm the procedures to use for system modification.

Complete the following tasks **BEFORE** adding the IN2 MFC to the system:

- Notify the supervisor and/or the system operator that the system will be taken off-line.
- Notify the Manufacturing Coordinator or the Plant Manager that the system will be taken off-line.
- Notify local OSHA/HazMat Coordinator that the system will be taken off-line.
- Purge the system using the purge procedures specified by the system manufacturer.

DANGER

The system in which the IN2 MFC is being installed may contain a process gas that is TOXIC, EXPLOSIVE, CORROSIVE, or COMBUSTIBLE. Make certain that the system is COMPLETELY FREE of gas BEFORE opening the system to install the IN2 MFC. If there are no purge requirements from the system manufacturer, call Celerity for assistance before proceeding with the installation. In the U.S.A., CELERITY phone 1-972-359-4000 fax 1-972-359-4100).

- Notify the workers in proximity to the installation site that the system will be taken off-line for a component replacement. If local OSHA/HazMat procedures require evacuation during system modification/maintenance, make certain that all workers have left the area before continuing with the installation.
- Close the upstream and downstream shut-off valves to isolate the section of the system in which you are installing the IN2 MFC.

NOTE: If the system does not currently have upstream and downstream shut-Off valves, it is recommended that they be installed now. The ability to isolate the IN2 MFC by closing the upstream and downstream shut-off vales will be helpful for maintenance, repair, or for future upgrades.

2.5 COMPLETE THE MECHANICAL INSTALLATION

1. Prepare the system to accept the IN2 MFC.
2. If replacing an existing flow controller/meter, turn off the source that supplies its electrical power and ensure there is no flow in the system.
    a. Disconnect the electrical connection(s).
    b. Remove the IN2 or existing MFC.

       For VCR, disconnect the plumbing connections on either side of the existing unit, and carefully remove the unit from your system.

       For Surface Mount, remove the four screws securing the base and carefully lift the unit from the surface substrate.

    c. Place the removed MFC in a protective bag or container, seal the bag or container, and for Celerity MFCs, arrange for the removed unit to be repaired (see APPENDIX K, page 74), returned to inventory, or disposed of according to accepted industry practices. For other MFCs, consult local procedures for correct action to take with removed MFC.
3. If adding the IN2 MFC to a new system in which a spoolpiece has been installed to simulate a flow controller/meter, disconnect and remove the spoolpiece.

2.5.1 VCR

If plumbing a new system, allow for proper seal face dimension to accommodate the IN2 MFC (IN2 dimensions are found beginning in APPENDIX F, page 54). Leave the space open, then complete all of the plumbing on either side of the proposed installation location.

NOTE: Allow enough room for the IN2 MFC so that there is easy access to the plumbing and the electronics. This will simplify maintenance, repair, and future upgrades. If plumbing the installation for the IN2 for the first time, use pre-cleaned or ultra-clean tubing. This will help to reduce the possibility of introducing contamination during installation.

1. Clean the installation area in accordance with local standard cleaning procedures to remove any potential contaminants.
2. Make certain the proper gaskets are present before installing the IN2 MFC.

⚠ WARNING ⚠
do not proceed with the installation until the gaskets and seals are present. damage to the IN2 and dangerous gas leakage can occur if the proper gaskets seals are not used.

3. Remove the IN2 MFC from its protective shipping containers.
4. Remove the IN2 MFC's protective end caps.
5. While observing gas flow direction (align with arrow on front of IN2), insert the gaskets into the VCR connectors and connect the IN2 MFC to the system.

⚠ CAUTION ⚠
damage to equipment and/or the system can occur, and The IN2 will not function unless the gas flow is in the proper direction.

6. Tighten the VCR connectors to the torque specifications provided by the manufacturer (typically 1/8 turn past hand-tight).

NOTE: If uncertain about the torque specifications, contact the seal's manufacturer.

2.6 SURFACE MOUNT

1. Clean the installation area in accordance with local standard cleaning procedures to remove any potential contaminants.
2. Make certain that the proper seals are present before installing the IN2 MFC.

⚠ WARNING ⚠
do not proceed with the installation until the proper seals are present. damage to the IN2 and dangerous gas leakage can occur if the proper seals are not used

3. Remove the IN2 MFC from its protective shipping containers.
4. Remove the IN2 MFC's protective base.
5. While observing gas flow direction (align with arrow on front of IN2), place the unit with proper seals onto the surface substrate.
6. Align the pre-drilled holes on the base of the unit with the holes on the substrate. Place four stainless steel screws (not supplied) into the holes and hand tighten.
7. Torque screws to local or seal manufacturer's specifications.

NOTE: If unsure about proper torque, call your Celerity representative.

2.7 COMPLETE THE ELECTRICAL CONNECTIONS

1. Before attempting to make the electrical connections, confirm that the connector type and signal/pin configuration of the existing wiring EXACTLY match the connector at the top of the IN2 MFC. If the connectors EXACTLY match one another, continue with this step. If the connectors **DO NOT** exactly match, refer to **Table A, "Connector Wiring," on page 43** for wiring pin-outs**.** (Take heed that there are two 9-pin connectors. Make sure the required configuration of the IN2 that is being installed)
2. Test the interconnect cable for:
   - Continuity
   - Pin-to-pin shorts
   - Correct pin assignment
3. Use the electrical hook-up diagram to identify electrical values, pin assignments, and input/output voltages.
4. Connect the power/signal source input to the input port on the IN2 MFC. The IN2 MFC can be configured to accept 3 types of connectors:
   - DeviceNet
   - High Density D-Subminiature 15-pin
   - D-Subminiature 9-pin (There are two 9-pin connectors: Standard and "T". (See Appendix A for pin outs)
5. For the 9-pin or 15-pin HD subminiature connectors, make sure that the connector is securely inserted and that the two knurled nuts are hand-tightened.
6. For the DeviceNet connector, make sure the connector is hand-tightened.
7. Secure all electrical connections. Ensure that all shielding, grounds, and other electrical safeguards have been installed or reinstalled.

⚠ CAUTION ⚠
DO NOT OPERATE the IN2 MFC unless all electrical connections comply with Celerity' operating specifications, the system manufacturer's electrical requirements, and all osha/hazmat mandates.

2.8 CHECK THE SYSTEM FOR LEAKS

The following guidelines enhances your safety and minimize system downtime. They augment, but do not replace the existing system leak check procedures.

⚠ CAUTION ⚠
check with the facility and health safety department to confirm the procedures that should be used for checking the system for leaks.

In order to leak-check the system with the IN2 MFC, verify that the valve is in the open position.

1. Refer to the model number that was copied on page 6. If the first character in the model number is:
   - **P** - the valve is normally **OPEN**
   - **D** - the value is normally **CLOSED**
   - M - unit is a Mass Flow Meter

2. To open a valve that is normally closed, apply the following voltage:

Table 4: VOLTAGE VALUES

CONNECTION	VOLTAGE	APPLY TO
9-pin	+ 5V DC	Pin 6
15-pin	Ground	Pin 13

3. After confirming that the valve is **OPEN**, use the following procedures to test the system for leaks:
   a. Open the upstream and downstream shut-off valves.
   b. Purge the system with dry nitrogen to remove any air, moisture, or contaminants that may have entered the system during installation.
   c. Fill the system with helium and pressurize to normal operating pressure.
   d. Using a calibrated helium leak detector, thoroughly check the plumbing connections and the IN2 MFC for leaks.
   e. If no leaks are detected, prepare the System for Start-up. If a leak is detected, refer to Appendix B, Leak Detection and Correction Procedure.

2.9 PREPARE THE SYSTEM FOR START-UP

1. Turn on the circuit that supplies electrical power to the IN2 MFC (previously turned off).
2. Confirm that the IN2 MFC control valve is in the **OPEN** position (see Step 6 for instructions).
3. Confirm that the upstream and the downstream valves are in the **OPEN** position.
4. Purge the system using dry nitrogen to remove any air, moisture, or residual contaminants that may have entered the system during the leak detection process. Follow the system manufacturer's specifications for purging the system.
5. Initiate a "cycle" purge if this process is approved by the system manufacturer.

NOTE: A cycle purge involves running a purge gas through the system followed by a system pump down. This cycle is repeated several times. The process helps to remove contaminants from small blind cavities that can create a virtual leak source. For additional information on this process, contact Celerity' Technical Support.

6. Apply power to the IN2 MFC and allow 30 minutes for the system to warm up.

⚠ CAUTION ⚠
Do not pressurize the system with process gas until the warm-up period is over.

NOTE: The 30 minute warm-up period is critical in order to stabilize the controller and ensure accurate flow rates. Flow errors and inaccurate readings may occur if a cold IN2 MFC is required to control gas flow.

7. While the system is warming up, refer back to the Safety Features section page 3. Installation personnel and/or the system operator should be familiar with the contents of this section **BEFORE** the process gas is introduced and the system is placed back on-line.

2.10 BRING THE SYSTEM BACK ON-LINE

1. If required, remove valve signal.
2. Repressurize the system with process gas.
3. Confirm that the IN2 MFC has had power applied to it for the specified 30-minute warm-up period.

2.11 ON-TOOL GAS CONFIGURATION

To configure the IN2 MFC while “on-tool”, refer to the Reprogramming steps as described in “USER SOFTWARE INSTALLATION” on page 20.

2.12 ON-TOOL ZEROING OF DIGITAL MFC

On-tool Zeroing of the IN2 is advised whenever the IN2 is initially installed, repositioned (re-oriented), re-installed, or when a new gas or flow rate has been configured. Different gases and flow rates as well as positioning can cause differential heating/cooling on the Sensor resistive bridge. By zeroing the IN2, a more accurate flow indication occurs. To zero the IN2, follow the steps “Zeroing The IN2” on page 37.

⚠ CAUTION ⚠
Zeroing the IN2 should only be performed by someone knowledgeable with procedure and results. Call Celerity Support for help or information.

2.13 NOTIFY PERSONNEL THAT THE SYSTEM IS ON-LINE

1. Notify the immediate supervisor and/or the system operator that the system is now on-line.
2. Notify the Manufacturing Coordinator or the Plant Manager that the system is now on-line.
3. Notify the local OSHA/HazMat Coordinator that the system is now on-line.

3.0 IN2 USER SOFTWARE

3.1 IN2 USER SOFTWARE—VERSION 2.5

Celerity's IN2 User Software is a user-friendly resource for programming and monitoring the performance of IN2 Digital Mass Flow Controller(s) and Meters. It provides a digital communication link between a personal computer and up to 32 IN2 Digtal MFCs via an RS-485 interface, which is available through either the IN2 2.5mm analog connector or by use of DeviceNet connection. The software is a PC based only program which incorporates diagnostics using a Graphical User Interface (GUI), and a Configuration Program.

The software supports all gases either pure or mixed (Semi identified only) suitable for use in the IN2. If the gas to be used is not supported, call Celerity at the nearest office. Phone numbers are located in the back of this manual.

The software is serialized, with the license being good for one year (365 days) from the date of loading. Licensing is for a single site; one serial number per user. If the license is not renewed, stored information is automatically removed and the software becomes inoperable.

User configurability allows users to program the IN2 to virtually any gas and range within select boundaries. In addition, the user can quickly scan the performance of the IN2 Digital Flow Controller(s) on four critical parameters:

- Flow (sccm)
- Valve Current (mA)
- Setpoint (sccm)
- Troubleshooting

These values for Flow, Valve Current and Setpoint are updated and displayed in real time so that the user can quickly and easily identify any problem or out-of-specification condition.

Whenever the performance of an IN2 Digital Flow Controller is compromised, the program displays a highly visible red alarm indicator. Displayed along with the alarm is a diagnostic message that identifies the malfunction. By matching this diagnostic message with the reference information**,** the user will be able to identify the most probable cause of the problem and determine how to resolve it.

The software will also permit the user to display a graph of each controller's performance and produce a hard copy of the graph for backup purposes.

The program composes of three sections as shown in Figure 5.

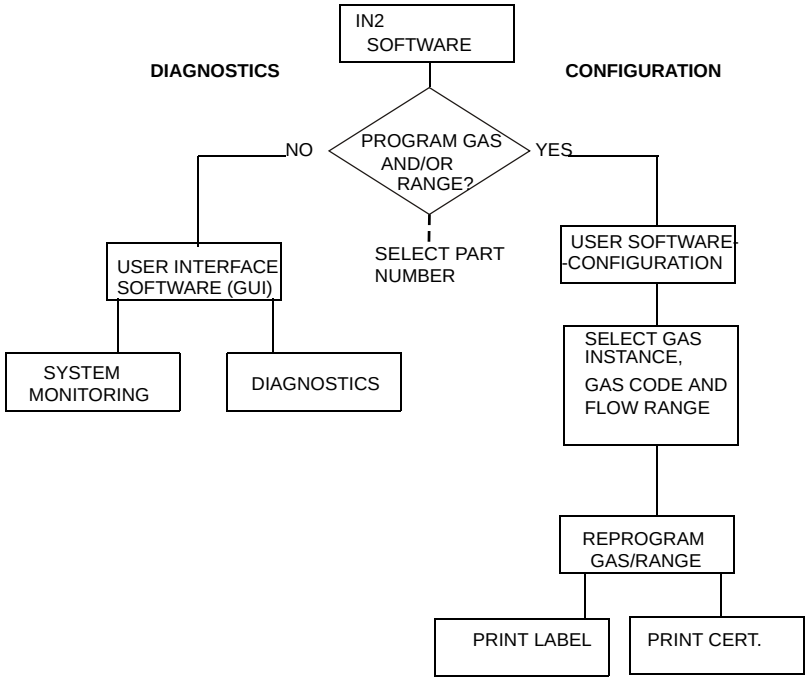


Figure 5: IN2 User Software Flow

3.2 DIAGNOSTICS SECTION:

- User Interface Software (GUI) - provides Graphical User Interface for system monitoring and diagnostics.

  System Monitoring - provides real time monitoring of Flow (sccm), Valve Current (mA), Setpoint (sccm), and trouble indication. See page 29 Figure 26 for options and Table 5, “OPTION SELECTION,” on page 30 for an explanation of each.

  Diagnostics - displays messages and conditions to help in troubleshooting.

- User Software Configuration - reprogramming of gas/range, printing labels and certificates of certification are accomplished in this section. See “IN2 USER SOFTWARE—Version 2.5” on page 14 for details.

The following explains how to install and use the software to maintain optimum performance of installed IN2 Digital Flow Controller(s).

3.3 CONFIGURATION PROGRAM

The Configuration Program allows for reprogramming up to 8 gas instances with flow range. The Electronic Data Sheet Screen (EDS), the main screen, displays the current IN2’s configuration. Changes to the configuration, selection of History, looking up a gas code, printing labels and certification, using DeviceNet, and verification of the correct part number can be accomplished from this program.

A customer specific part number can be entered into the “Customer Part Number” field. Information entered into this field will be printed on the label (generated from the Field Kit Printer) that is placed on the top of the IN2. This part number takes the place of the Celerity part number.

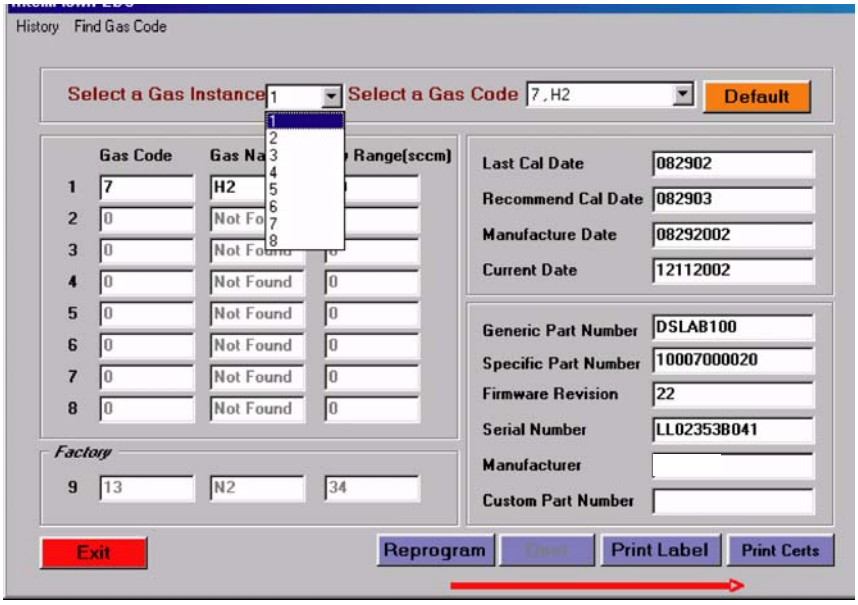


Figure 6: IN2 User Software EDS Screen Example

3.4 DEVICENET SELECTION

When the IN2 is configured as a DeviceNet Unit, selection of DeviceNet functionality is accomplished by clicking on DeviceNet at the bottom of the EDS Screen.

1. Select the appropriate configuration in the top pull-down menu.
2. Click **Change Configuration** and then **Test.** If no error messages appear, click **Exit.**
3. From the **EDS** screen, click **Exit**. Power cycle the MFC and then start the configuration program.
4. Verify that the first digit of the **specific part number** (see Figure 6) equals the selected **DeviceNet** option.

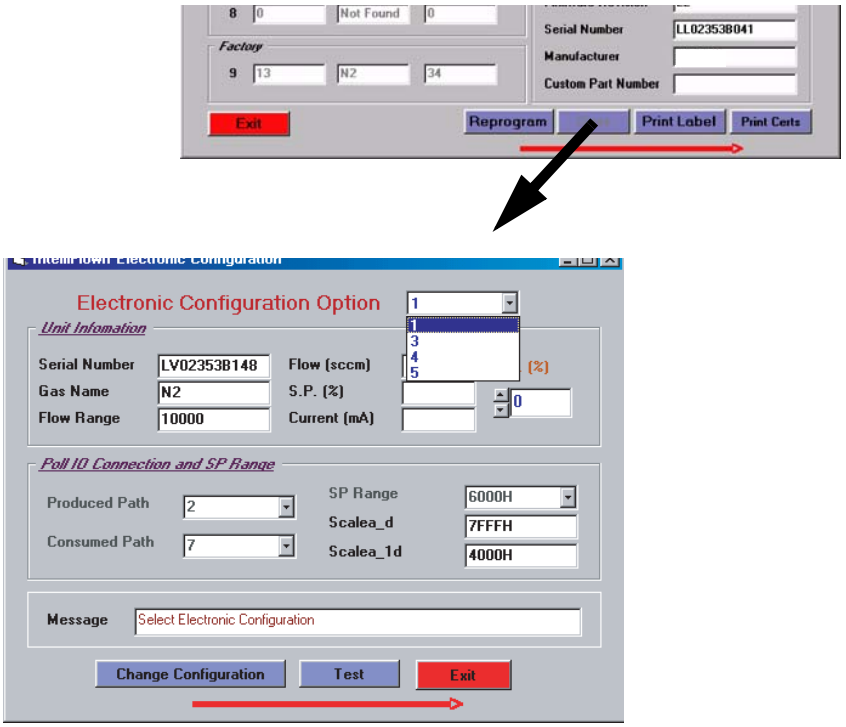


Figure 7: Electronic Configuration Options Screen

3.5 DIAGNOSTICS PROGRAM (GUI)

3.5.1 Help Screen

The Help screen, which is selected from the Software control screen, displays the Software version number, Serial Number, expiration date, and the phone number for Celerity Help. Information regarding the system the Software is loaded on can be accessed by clicking on System Info. When reporting a problem, the information from the Help and System Info screens will must be provided.

Figure 8: User Software Help Screen

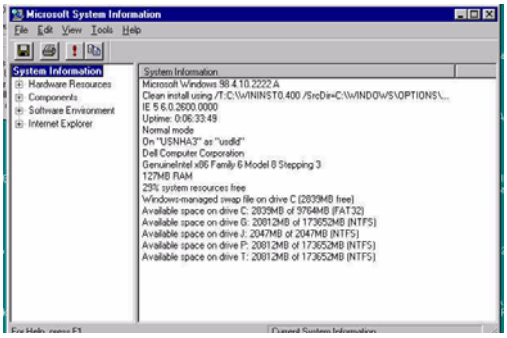


Figure 9: System Information Screen

3.5.2 Password

Password protection is provided for protection of unauthorized use of the Software. There are three levels of access:

- Configuration
- Diagnostics
- Manufacturing (Factory use only)

The initial password is "**password**" (Factory password is not obtainable outside the manufacturing facility). The password can be changed by selecting **Change Password** from the top of the main screen.

3.5.3 Configuration Program History

Each time a program event occurs, the programmed gas and the total flow is permanently stored in non-volatile RAM. Selecting **History** from the **EDS** screen display the last ten events for the IN2 in chronological order. (If there were more than ten events the older events are erased) This information is useful to ensure non-compatible gases are not used on the same IN2. It states the last reprogramming which could be helpful for quality reasons.

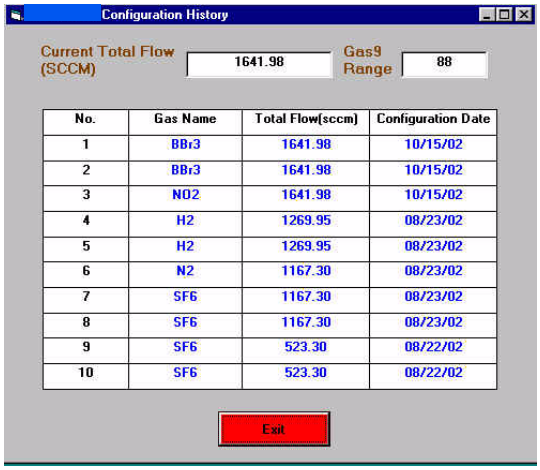


Figure 10: Configuration History

⚠ CAUTION ⚠
It is not necessary to take an IN2 MFC off-line in order to make electrical connections to the diagnostic or the RS-485 pins of the analog connector. However, as with any electrical installation, care should be used and adherence to standard industry practice in making the connections.

NOTE: The software may be installed on a computer whether or not any IN2 Digital Flow Controllers are installed in the system or are connected to the computer. However, in order to activate the software, one or more IN2 Digital Flow Controllers must be installed and connected to the computer.

3.6 PC SPECIFICATIONS

3.6.1 Minimum PC Requirements

PC	Pentium II 300mhz
Memory	64MB
Hard Disk Space	25MB of free space
Monitor	SVGA
Operating Systems Supported	Windows® 98, Windows® XP, Windows® 2000, and WinMe (Windows® 95 not supported)
CD-ROM Drive	

3.7 SERIAL COMMUNICATIONS

The IN2 communicates with the User Software through the serial port of the PC. Interface “kits” (Kits come supplied with a 2.5mm Diagnostics cable which should be connected to the serial port of the PC for operation.

NOTE: All communication programs such as PDA sync programs should be disabled.

For additional information, contact a Celerity account representative or any member of Celerity’s worldwide network of technical service staff (phone numbers located in back of this manual).

4.0 USER SOFTWARE INSTALLATION

Installing the IN2 User Software follows standard Windows® operating system guidelines. Before beginning the installation, complete the following items:

- Confirm that the computer on which the software is to be installed meets the minimum specification. (see “PC Specifications” on page 19)
- Start the computer and close any open applications.
- Un-Install any existing INx based programs.
- Confirm the default directory where the User Software will be installed (example: C:\Program Files\Celerity IN2) is acceptable to you and your system administrator. (The program will ask for this information during the Installation.)
- Establish an available Serial Com Port.
- Confirm that the User Software installation CD is available.
- Confirm that the PC or laptop the software is being loaded onto is or will be connected to the IN2 (s) that the software will be monitoring.
- Confirm that there is at least 5 MB of free space on the hard drive in order to accommodate the software.

To install the software, complete the following steps:.

NOTE: 1. All mouse -related functions refer to the LEFT mouse button.
2. The Install Wizard can be terminated at any point by clicking CANCEL.

1. Insert the IN2 User Software CD into the appropriate Drive. Open the drive and the CD.
2. Double click “**Setup”** to display the Welcome window of the Installation Wizard.
3. The Install Wizard screen (See Figure 11) will appear. After reading the information, Click **Next>** to continue or **Cancel** to Quit the installation.
4. The License Agreement Screen will appear. If there is agreement with the license agreement, select the “**Agree Box**.” Click **Next>** and continue with step 6.

   •If there is no agreement, select the “**Do Not Agree Box”** and click **Next** to terminate the installation.
5. The next screen to appear is the “**Read Me**” screen where directions or pertinent information is needed for successful use and/or Installation of this program is displayed. Click **Next>** to continue with the Installation.
6. At the appearance of the Customer Information screen, enter the User’s Name and Organization as requested and Click **Next>** to continue.
7. The “**Destination Folder**”, the next screen, displays the default location for the program file. If the program file is to be installed elsewhere (different from the information presented on the screen) Click **Change** and follow the directions given. Click **Next>** when satisfied with information or changes
8. One last attempt to assure that all information needed for successful installation is presented on the “**Ready to Install**” screen.

   •Click **Install** if everything is correct.

•If changes are needed, click **<Back** until the proper screen appears containing the information that is to be changed. Upon completion of changes, follow the screen's directions to continue the installation.

9. The Installation Wizard will proceed to install the program.

10. At the conclusion of the installation Click **Finish** to complete the IN2 User Software portion of the installation. To complete the installation, proceed with the installation of the Diagnostics (Graphical User Interface) portion of the installation which follows.

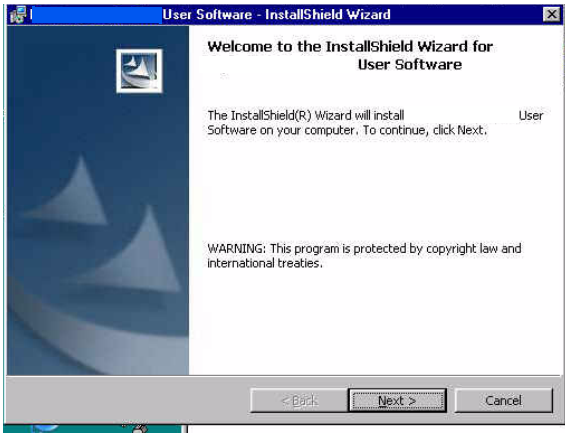


Figure 11: Installation Wizard Screen

4.1 GRAPHICAL USER INTERFACE INSTALLATION (V 2.2.8)

After the IN2User Software has finished installing, the Diagnostics portion (GUI) portion of the Software is ready to be installed using the following procedures.

1. After the installation of the User Software, the Installation Wizard screen for the GUI will appear (See Figure 12:, Diagnostic's Installation Wizard Screen). Select **Next>** to proceed with the installation.

2. Verify the correct folder where the application will be installed. When satisfied with the location, select **Next>**. The wizard will install the program.

3. When the installation is completed, click **Finish.** The installation is now complete.

NOTE: To simplify access to the user software, a shortcut ICON may be dragged from the Celerity IN2 directory to the Desktop.

Figure 12: Diagnostic's Installation Wizard Screen

4.2 LICENSE FILE

The following pop-up screen will appear the first time upon installation of the version 2.5 software.

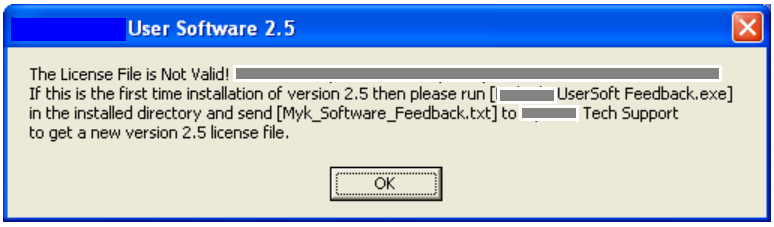


Figure 13: First time use Version 2.5 Screen

The user has to E-mail or phone in "Myk_Software_Feedback.txt" in order to receive a valid license file. (Celerity Technical Support: E-mail: tech_service@Celerity.net. Phone: 1-972-359-4000 ext. 4521).

The following pop-up will appear if the user is trying to copy a valid license file from one machine to another.)

Figure 14: Notification of improper license use.

4.3 COMPUTER CONNECTION TO RS-485 PORT ON IN2

To connect the IN2 MFCs to the computer running the software, complete the following steps. This procedure is based on use of the Field Kit (see the IN2 manual).

1. It is recommended that the computer or laptop on which the software will be installed be turned off.
2. At the PC, connect the serial cable between the PC and the IN port of the

Switch Box. See Figure 16 (See Figure 17 for DeviceNet connection).

3. Insert into Port A of the Switch Box, the RS-232 end of the RS-232/RS-485 Converter.
4. Insert the DB9 end of the diagnostic cable (either the 2.5mm to DB9 or RJ-11 to DB9) into the DB9 port (marked RS-485) on the RS-232/RS-485 converter.
5. If only one IN2 is to be monitored, insert the 2.5mm diagnostic connector into the diagnostic port located on the top of the IN2 controller.
6. If two or more IN2s are to be monitored, Electrical Adapters are available for use in “daisy chaining” the IN2s together (XXXXX). Connect the RJ-11 connector (from the RJ-11 to DB9 cable) to the IN2 nearest to the PC.
7. Connect the label printer to **Port B** of the Switch box. (Printer needs to be connected to a power source or the charged internal battery and have the labels (supplied) installed.)

NOTE: DeviceNet Digital MFCs have an internally generated RS-485 address of 1; which means they cannot be daisy-chained.

8. Set each IN2 unit to a unique address (MACID) using only numbers between 1 and 32. (Program will not recognize MACID greater than 32) MACID are created by rotating the two address switches on the top of the IN2 case (see Figure 18) with a small flat-blade screwdriver. The switch marked MSD determines the most significant digit of the address, and the switch marked LSD determines the least significant digit. For example, rotating the MSD switch to position 2 and the LSD switch to position 7 sets address 27. Setting two units to the same MACID will cause communication conflicts and errors.

NOTE: Since the IN2 are daisy chained together, It is suggested that the IN2 directly connected to the computer be the lowest number set. The IN2 closest to the computer is always in position one of the main menu screen.

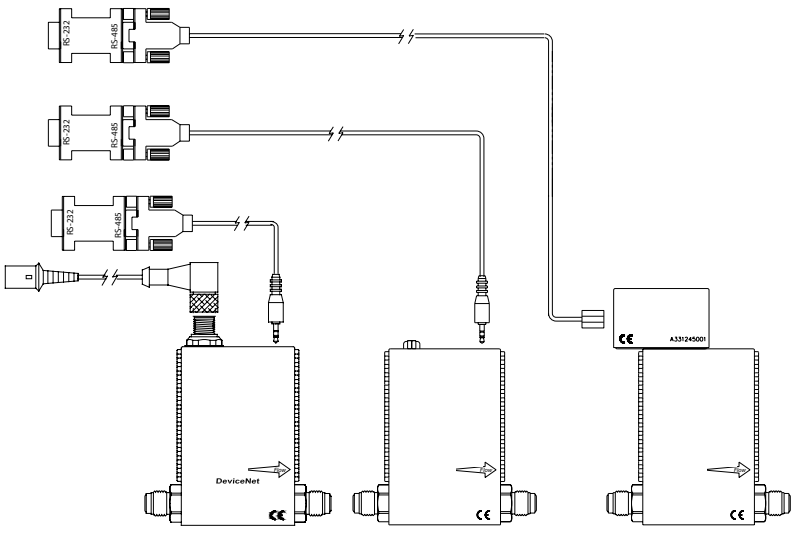


Figure 15: Diagnostic Cables

4.0

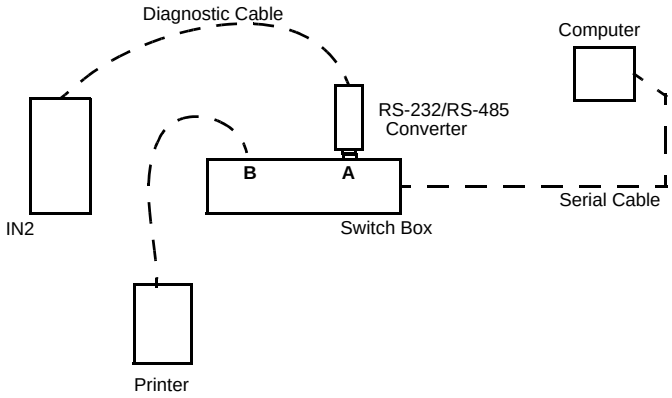


Figure 16: Computer Connection (Analog)

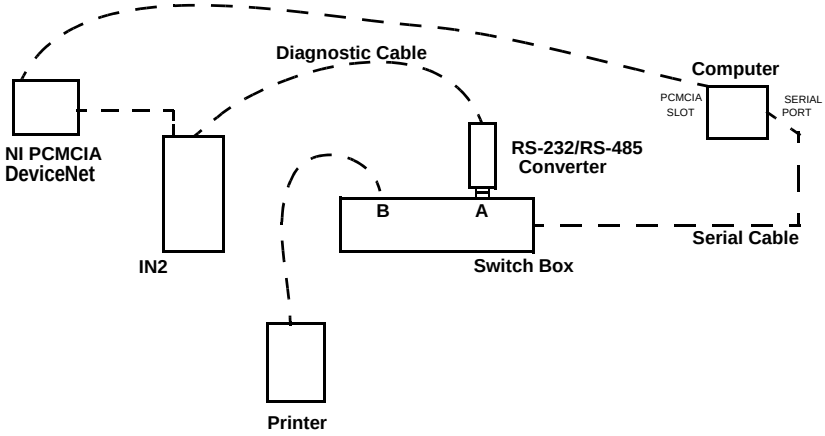


Figure 17: DeviceNet Computer Connections

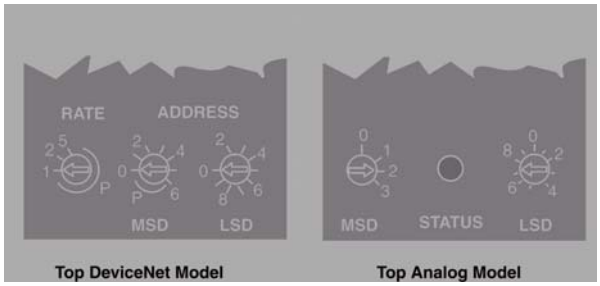


Figure 18: Typical Rate and Address Switches Location

5.0 SOFTWARE OPERATION

NOTE: THERE MUST BE AT LEAST ONE IN2 MFC INSTALLED IN THE SYSTEM WITH COMMUNICATIONS LINKED TO THE COMPUTER ON WHICH THE SOFTWARE IS LOADED.

5.1 START

1. Open the User Software by double clicking the ICON on the PC or by selecting the file from the Program File.

If proper communications has been established, the first screen will be similar to the one shown in Figure 19.

2. Select the appropriate Com Port if different from the one shown.
3. Select a function from the drop down menu (either Configuration, PN Select, or Diagnostics) that is needed to accomplish the task. (See Figure 19:, User Software Screen). Refer to page 15 for the decision process.
4. Enter appropriate information asked within the task. When task is completed, select End to exit the program.

Figure 19: User Software Screen

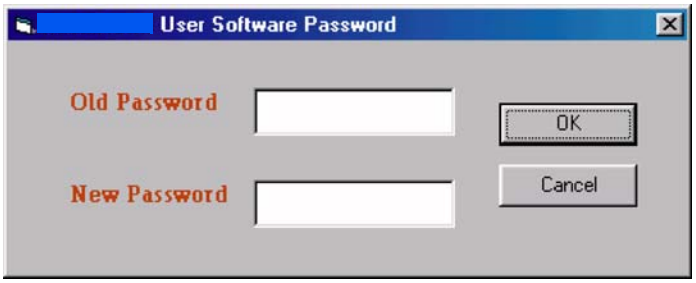


Figure 20: User Software Select New Password Screen

Figure 21: User Software Enter Password Screen

5.2 CONFIGURE GAS OR RANGE

This procedure requires that no gas is flowing through the IN2 and that proper software and Field Kit are in use. The user will need to know the SEMI gas code. If the SEMI gas code is not known, the user can select **PN Select** from the main screen and use the drop down menu of **Select a Gas Code** (Gas code and associated gas symbol) or **Select a Gas Symbol** (Gas symbol and associated gas code). The Gas Code can also be selected from the EDS screen **Select a Gas Code** dropdown menu which offers the same section as that presented in the **PN Select** screen.

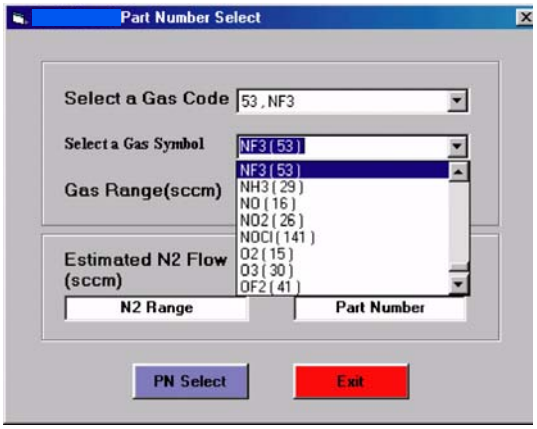


Figure 22: Part Number Select Screen

1. Ensure all electrical and mechanical installations are completed and that the IN2 is connected to a PC containing the IN2's User Software.

NOTE: This procedure requires using the field kit available from Celerity. See "Kits and Accessories" on page 69.

2. Apply power to the IN2.
3. Start the Celerity User Software application on the PC.
4. Select the proper **Com Port** then **Configuration** from the **Prg Mode** dropdown window. Click **Start**.
5. Enter appropriate password. (A password is required each time the software is started).
6. The Warm up time reminder window will appear and ask if the IN2 has warmed up. Click **YES** to continue. Clicking **No** returns to the opening screen

(Step 4).
If YES is selected, the Electronic Data Sheet (EDS) Screen will appear. It will look similar to the one shown in Figure 23. This screen displays the current configuration of the IN2. It will not show the specific part number as this will depend upon the selected gas.

NOTE: The Gas Instance 9 is reserved for factory use and will always be programmed for N_2 with the Flow Range equal to the maximum flow of the bin.

7. From the EDS Screen, select the **Gas Instance** number from the drop down window.

NOTE: 1. At this point, a new gas and range can be reprogrammed into a gas instance, or an existing gas instance may be changed.
2. Selecting default will clear all gas instances and return gas instance one to the factory programmed gas (n_2).
3. Active gas instance can also be changed.

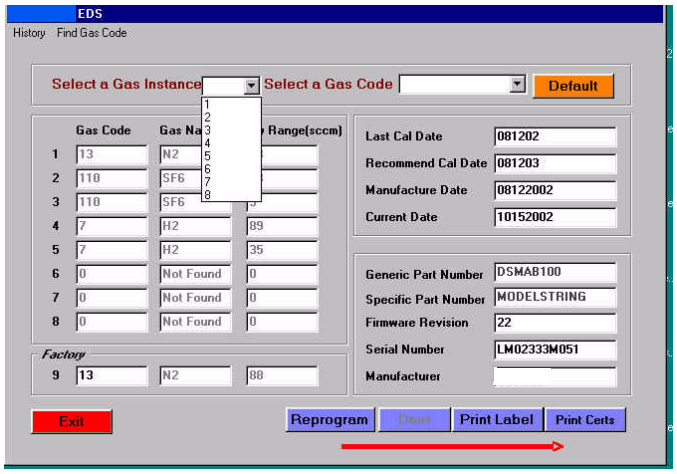
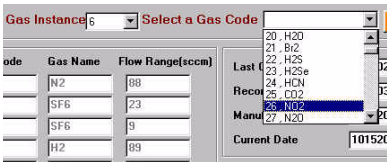


Figure 23: Electronic Data Sheet (EDS) Screen

8. Select the appropriate Gas Code from the drop down window.



9. The Gas Code and Gas Name will appear in the Gas Instance selected. Double click the cursor in the existing Flow Range field and enter the desired Flow Range (sccm). (When the Flow Range box is selected, a pop-up window states the usable flow range for the gas selected.)
10. Ensure that the gas and flow range selected is correct. If not, return to Step 9.
11. If the information is correct, Click on the **Reprogram** button.
12. Click **Print label**. A Label will be printed from the field kit printer*. Place the label on the top of the unit either replacing the existing label or placed over the existing label. The label identifies the gas and range in use for this IN2.
13. Open the GUI portion of the software and perform the **Select New Gas** routine to complete the update of the gas in use.

NOTE: Always print a new label and place it on top of the IN2 after changing gas and/or range

**See printer User's manual for proper Label insertion and operation. The IN2 User's Software contains all commands for printing using the printer supplied in the Field Kit.*

5.3 PRINT LABELS

To print a label, it is necessary to have the IN2 Field Kit connected as described in Appendix I.

To print labels do the following:

1. Open the IN2 Software. (NOTE: THERE MUST BE AT LEAST ONE IN2 MFC INSTALLED IN THE SYSTEM WITH COMMUNICATIONS LINKED TO THE COMPUTER ON WHICH THE SOFTWARE IS LOADED.)
2. Select Configure from the drop down screen.
3. Answer any questions and enter password.
4. From the Reprogram Screen, Select the Gas Instance for which the label is to be printed.
5. Click **Print label**.
6. Cut off label using the printer cutter and apply the label to the top of the IN2.
7. Exit the Reprogram Screen then Exit the main screen to exit the program.

5.4 GRAPHICAL USER INTERFACE (GUI)

The Graphical User Interface (GUI) is accessed through the System Software. (If the GUI is loaded separately, both programs, User Software and Graphical User Interface, cannot run simultaneously due to the use of the same serial port on the computer.). The following steps describe the access and function

1. Open the User Software application.
2. From the Main window of the **User Software**, select **Diagnostics** from the **Prg Mode** drop down menu.

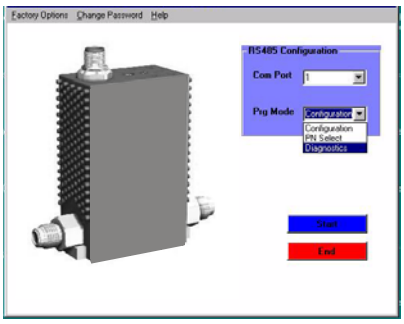


Figure 24: Disgnostic Select

3. The program will open and ask for a selection of a Com Port. After selection of the Com Port, the program will begin searching for the IN2s (Up to 32 IN2s) that are connected to the computer. When the search is completed, the Main screen will appear with data from the characteristics of the presently selected IN2(s) in groups of eight or 1 to 32. It is also the screen from which access to other functions takes place. (Figure 25)

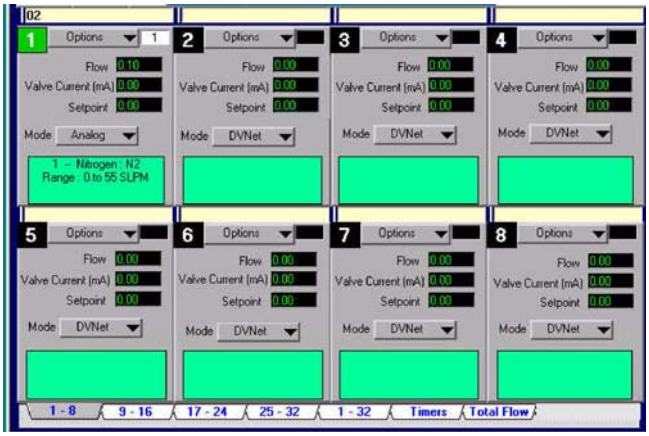


Figure 25: Main Screen

From the Main screen the user can select the following by selecting the drop-down Option window:

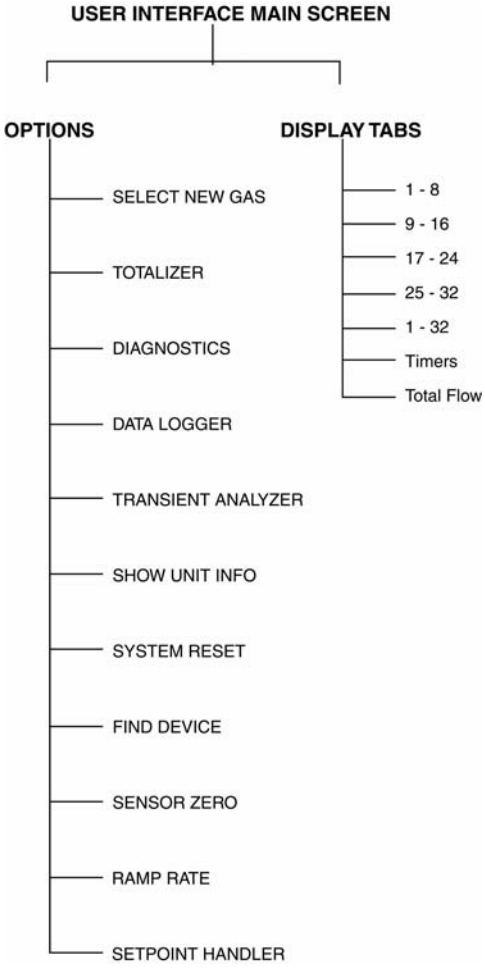


Figure 26: GUI Main Screen Selectables

Table 5: OPTION SELECTION

OPTION	DEFINITION	PASSWORD PROTECTED
Select New Gas	= Up to nine different gases are selectable	YES
Totalizer	= Displays current gas and range, total hours of IN2 use and time with flow, plus total sccm flow. Resetable function for short periods available.	YES
Diagnostics	= Displays condition and malfunction messages.	YES
Data Logger	= Displays in different chart forms percent of flow, setpoint and valve current.	NO
Transient Analyzer	= Acquires internally captured data from the IN2 MFC and displays it graphically.	YES
Show Unit Info	= Displays a comprehensive description of the IN2 MFC that is being monitored. In addition to the information presented on the Main Menu screen, the Unit Info screen provides dates, manufacturing serial numbers, and software version data.	NO
System Reset	= Resets parameters to zero (default)	YES
Find Device	= Causes Status Indicator LED to flash which helps the user to physically locate the IN2 in the system.	NO
Sensor Zero	= Resets sensor to zero.	YES
Ramp Rate	= Identifies the ramp time imposed on setpoint changes.	YES
Setpoint Handler	= Sets setpoint origin and setpoint delay	YES

Passwords are user configurative.

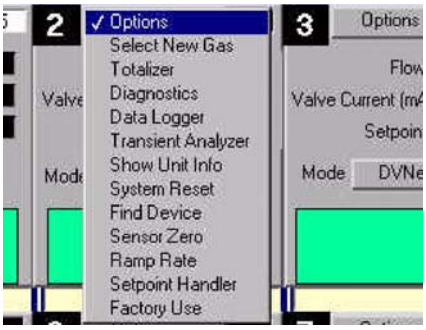


Figure 27: Options Menu

5.5 PASSWORD PROTECTION

To protect the critical data that it is monitoring, the software has password-protection. A Password is initially provided and may be changed at the user's option by selecting File/Change Password (Initial password is "a blank box"). The password protection is case sensitive and should be limited to eight characters.

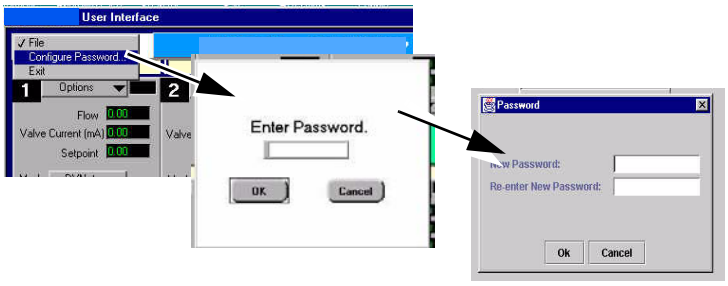


Figure 28: Enter Password and Change Password Windows

To set a password, select “**File”** from the top of the Main Screen. Select “**Change Password”,** then type in the default password or one that is currently in use, in the first widow that appears then select the “**Ok”** button. The **Change Password Window** will appear (See Figure 28). Enter the new password using any series of letters and/or numbers (eight characters are suggested). Retype the password in the next frame (to ensure that the first entry was accurate). Select “**Okay**”.

NOTE: Celerity recommends that the password be changed every 3 months or upon personnel change, to prevent unauthorized access to the software.

5.6 SOFTWARE FAMILIARIZATION

Figure 25 shows the main screen of the Diagnostic Mode. This screen consists of display boxes which correspond to the address of the IN2 being monitored and three critical parameters (**Flow** in sccm, **Valve Current** in mA, and **Setpoint** in sccm) for its associated flow controller.

In addition, the Main Screen displays the type of operating interface for the IN2 (Digital, Analog, or DeviceNet), Flow monitoring, Gas Type, and Range of Flow for each IN2. Also displayed is an identification block which has a dual function. 1.) The gas type and Range are shown. and 2.) Under normal operating conditions, the box is green. However, if the program detects a problem with a flow controller, the corresponding identification block turns red. “Diagnostics” can be selected from the Options menu and use of the software can help pinpoint the cause of the problem

The tabs displayed along the bottom of the Main screen window permit toggle between subsequent sets of eight IN2 controllers. A total of 32 connected IN2s, can be displayed.

The remaining tab, marked Timers & Flow, provide a time and flow summary for all IN2s monitored in the group selected.

The remaining button, **Option**, allows access to **Gas Selection**, **Totalizer**, **Diagnostics**. **Data Logger**, **Transient Analyzer**, **Sensor Zero**, **Unit Info**, **Ramp Rate**. These are explained in the following summaries. To access these windows, select **Options** from the main menu and then enter the password.

5.6.1 Gas Selection Screen

⚠ CAUTION ⚠
Apply all local directives for purging and gas use prior to changing to a new gas.

The Gas Selection Screen enables the user to select one of the possible nine (9) gas instances that have been programmed for that particular unit. (See Figure 29:, Gas Selection Screen Example) The screen shows the Unit address, current gas, surrogate gas, response gas, and gas range for selected gas and for each factory calibrated gas, and names and numbers of IN2 calibrated uses of gases. To select a different gas, click the Select New Gas button up or down to locate the number that corresponds to the gas required. Click anywhere on the screen and the Current gas changes to that which was selected along with the other information pertinent to that gas.

Click **Exit** to return to the main menu.

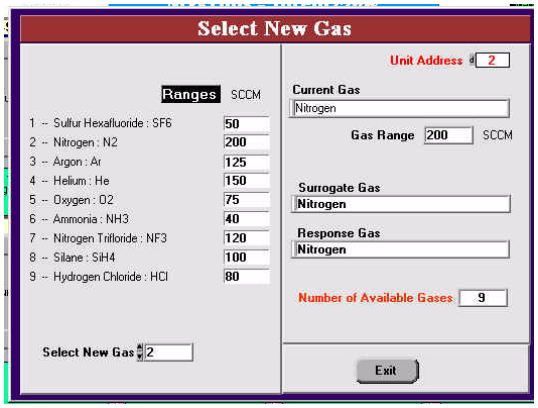


Figure 29: Gas Selection Screen Example

5.6.2 Totalizer Screen

4. The Totalizer screen displays total gas flow and total time. Variables include:

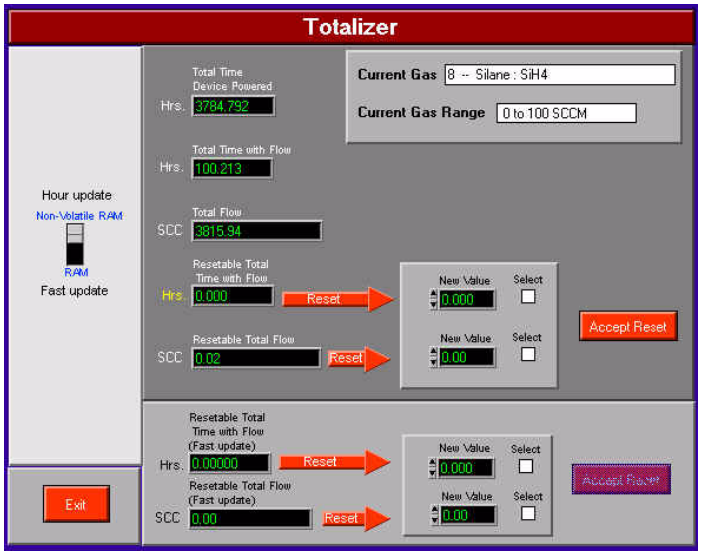


Figure 30: Totalizer Screen Example

1. Total Time IN2 Powered (Hours) – represents the total time from the point the IN2 receives power. The value of this variable is saved every hour on the Non-Volatile RAM. The value read is the hourly saved value from the Non-Volatile RAM. (Non resettable)
2. Total Time with Flow (Hours) – represents total time whenever there is gas flow greater than 2% of the full-scale range of the IN2. The value of this variable is saved every hour on the Non-Volatile RAM. The value read is the hourly saved value from the Non-Volatile RAM. (Non Resettable)
3. Total Flow (Standard Cubic Centimeter) – represents flow that has been accumulated over time whenever there is gas flow greater than 2% of the full-scale range of the IN2. The value of this variable is saved every hour on the Non-Volatile RAM. The value read is the hourly saved value from the Non-Volatile RAM (Non Resettable).

NOTE: To better understand the following points 4 – 7, refer to Figure 31.

Resettable Total Time with Flow (Hours) – represents total time whenever there is gas flow greater than 2%. The value of this variable is saved every hour on the Non-Variable RAM. This variable can be set to any value. This is achieved by entering a value in the “New-Value” control box, by clicking on the “Select” box, and by clicking on the “Accept Reset” button. The value read is the hourly saved value from the Non-Volatile RAM. The value changed here would effectively change the Point 6 variable.

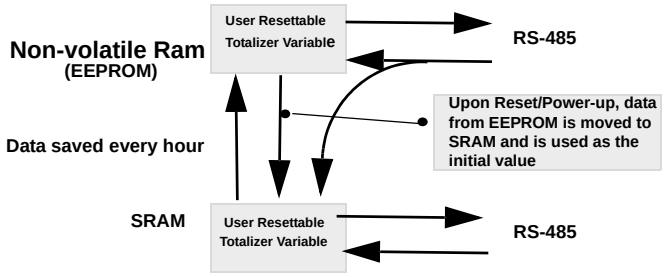


Figure 31: Memory Management Techniques

4. Resettable Total Flow (Standard Cubic Centimeter) – represents flow that has been accumulated over time whenever there is gas flow greater than 2%. The value of this variable is saved every hour on the Non-Volatile RAM. This variable can be set to any value. This is achieved by entering a value in the “New-Value” control box, by clicking on the “Select” box, and by clicking on the “Accept Reset” button. The value read is the hourly saved value from the Non-Volatile RAM. The value changed here would effectively change the Point 7 variable.
5. Resettable Total Time with Flow (Fast Update, Hours) – represents total time whenever there is gas flow greater than 2%. The value of this variable is saved every hour on the Non-Volatile RAM (it shares the same location in Non-Volatile RAM as the Point 4 variable). Upon the IN2 MFC reset, the Non-Volatile RAM Totalizer variable loads the data into the RAM Totalizer variable. This variable can be set to any value. This is achieved by entering a value in the “New-Value” control box, by clicking on the “Select” box, and by clicking on the “Accept Reset” button. The value read is the continuously updated value in the Static RAM.
6. Resettable Total Flow (Fast Update, Standard Centimeter Cube) – represents flow that has been accumulated over time whenever there is gas flow greater than 2%. The value of this variable is saved every hour on the Non-Volatile RAM (it shares the same location in Non-Volatile RAM as the Point 5 variable). Upon the IN2 MFC reset the Non-Volatile RAM Totalizer variable loads the data into the Static RAM Totalizer variable. This variable can be set to any value. This is achieved by entering a value in the “New-Value” control box, by clicking on the “Select” box, and by clicking on the “Accept Reset” button. The value read is the continuously updated value in the Static RAM.

5.6.3 Diagnostic Screen

The Diagnostics screen, selected from the Main Screen's Option menu, displays the IN2 real time operating status. This screen provides the user additional information and probable cause to alarms that the Main Screen has identified. Use of this information is limited to expertise of the user and the type of trouble. Normally the Diagnostics screen is placed in the OFF position. A brief explanation of the Diagnostics Screen windows is found in Table 6 this page.

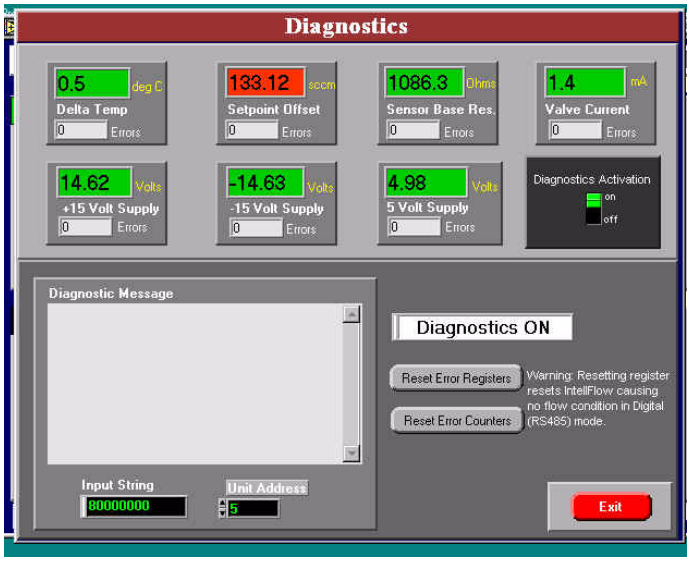


Figure 32: Diagnostics Screen Example

Table 6: DIAGNOSTIC SCREEN WINDOW DISPLAYs

WINDOW	DISPLAY
Delta Temp	Deviation in temperature of sensor coils from the time the IN2 was calibrated
Setpoint Offset	Amount of deviation of the actual Setpoint
Sensor Base Res	Resistance across the sensor in ohms
Valve Current	DC Current value controlling the Valve
+15 Volt Supply	Actual value of the +15 Volt Supply
-15 Volt Supply	Actual value of the -15 Volt Supply
5 Volt Supply	Actual value of the 5 Volt Supply
Diagnostics Activation Switch	Up = Diagnostics ON, Down = Diagnostics OFF
Diagnostic Message	Display a message indicating the probable cause of the error(s)
Reset Error Register	Resets all the registers for the indicated IN2
Reset Error Counters	Resets all the Error Counters for the indicated IN2
Input String	For Celerity Use Only
Unit Address	Unit Diagnostics is presented on

Table 7: SCREEN SEPARATING STATUS

BOX COLOR	CONDITION	OPERATION
Green	Normal	Within specifications
Red	Alarm	Our of specifications--Resolve immediately

The “Diagnostic Message” box identifies the out-of-specification parameters and determines the most likely cause of the problem. See IN2 manual for problem-solving suggestions.

The “Errors” box indicates how often the diagnostic parameter deviates from normal. To reset the counter to zero, click the “Reset Error Counters” button. To clear the information in the Diagnostic Message box, click the “Diagnostics Activation” button to “OFF” and then click “Reset Error Registers” button.

5.6.4 Data Logger Screen

The Data Logger records the Setpoint, Flow Reading, and Valve Current. Data is captured at approximately a 200 msec sampling rate as soon as the Data Logger is opened, and this data is stored in the computer’s memory.

NOTE: Because of its low sampling rate, the Data Logger is most effective for displaying and recording a steady state condition over a relatively long period of time. To analyze the dynamic condition that occurs during setpoint transients, use the Transient Analyzer (see next section) that captures data faster and saves it in the IN2s Volatile Ram.

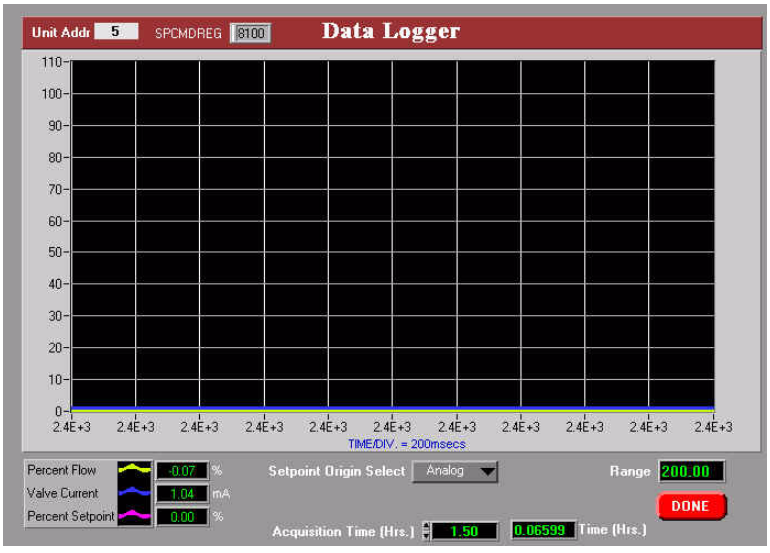


Figure 33: Data Logger Screen

To re-establish a Setpoint on the Data Logger in Digital (RS-485) mode, select “digital” from the Setpoint Origin Select drop down menu and enter a new setpoint value in the New Digital Setpoint% box.

When finished viewing the Data Logger display, click the “Done” button. You will be prompted to identify the path (Drive and File Name) to the location where you would like to save the data displayed on the Data Logger.

Acquisition Time can be set by user to any value. The default time is 1/2 hour (0.50). The user can exit at any time and store the data collected for the duration of the acquisition.

5.6.5 Transient Analyzer Screen

The Transient Analyzer acquires internally captured data from the IN2 MFC and displays it graphically. The data points are collected every 10.08 msecs for 3 seconds (300 data points). Retrieve the transient data by clicking on the “Retrieve Data from IFLOW” button. The entire data retrieval process takes about 5 seconds to complete.

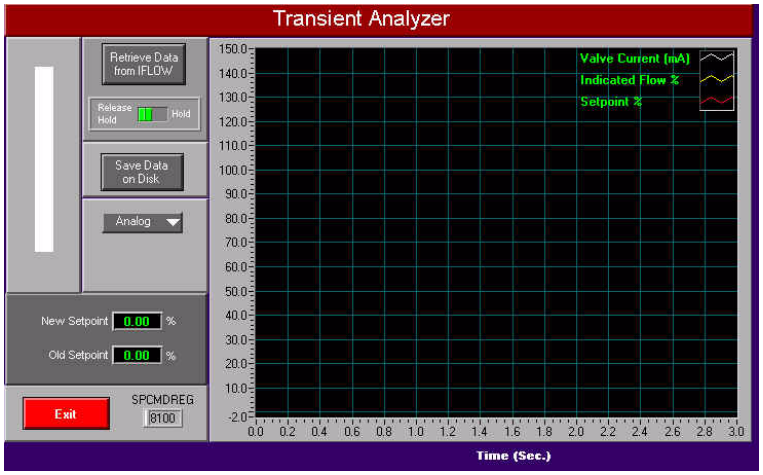


Figure 34: Transient Analyzer Screen Sample

Like the Data Logger, the Transient Analyzer displays Setpoint, Valve Current, and Indicated Flow. Although the Transient Analyzer acquires data at a faster rate than the Data Logger, data elements are held in the IN2 MFC’s Volatile RAM and will be lost if the system is reset or if power to the unit is interrupted.

As the Transient Analyzer Screen captures data, the vertical “Retrieval Status Bar” moves from “0” to “100%.” When the retrieval process is complete, the bar disappears and a graph of the data is displayed.

To change the setpoint, move the cursor to the Setpoint Origin Selector, press the “Digital” button, and enter the new setpoint in the box below. To display the data for the new setpoint, press the “Retrieve Data from IFLOW” button.

You can temporarily save downloaded transient data in the IN2’s Static RAM by placing the cursor on the “Hold” button and holding down the left mouse button until the button turns red and moves to the right. Alternately, you can permanently save data by clicking on the “Save Data on Disk” button and entering the path (Drive and File Name) to the location where you want to save the data.

5.6.6 Sensor Zero Screen

Sensor Zero allows for zeroing whenever the IN2 is initially installed or whenever the position of the IN2 has changed.

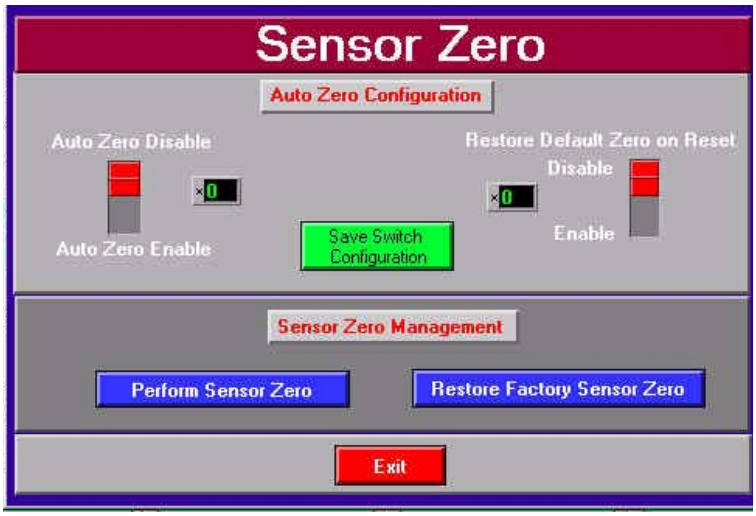


Figure 35: Sensor Zero Screen

5.6.7 Zeroing The IN2

NOTE: Sensor zeroing should only be performed by qualified individuals knowledgeable in the overall affects of the procedure. if the procedure is not performed properly, significant errors can occur in the calibration and readings.
1. Make sure the IN2 has been powered for several hours to ensure that the mfc and its electronics are warmed and at a steady state.
2. Make sure that the process gas has flowed through the IN2. the purging of the mfc should be thorough so that pure process gas is throughout the gas stick.

1. Read and comply with the preceding important note.
2. Close the isolation valve upstream of the IN2.
3. Wait until the gas pressure equalizes on both upstream and downstream of the IN2. This can be determined from a zero indicated flow condition.
4. Close the isolation valve downstream0 of the IN2.
5. Set the IN2 setpoint to 0%. (“Transient Analyzer Screen” on page 36)
6. Allow the IN2 to stabilize for 30 minutes.
7. Select **Perform Sensor Zero**.
8. The IN2 should now be zeroed.
9. Click **Exit** to return to main menu.

NOTE: Certain process gases have an issue with thermal siphoning, in those cases, it may be advisable to evacuate both upstream and downstream of the IN2. This is particularly an issue when the attitude of the IN2 is vertical. Thermal siphoning will have a negative impact on the zero setting. Once the IN2 has been evacuated and the isolation valves have been closed, return to Step 5 above to zero the IN2.

5.6.8 Ramp Rate Screen

The Ramp Rate identifies the ramp time imposed on setpoint changes. Normally, the IN2 response occurs immediately after a setpoint change, but the Ramp Rate feature allows you to force the IN2 unit to ramp up or down to the new setpoint over a specified period to provide a softer response characteristic.

The Ramp Rate can be set from 0.0m sec. to 30 sec. However, the Ramp Rate feature only turns on for values greater than 1000m sec. Any thing less than 1000m sec. would keep this feature turned OFF.

The default value is zero msecs. To set the Ramp Rate, enter the new value in the Ramp Rate Setting Box. You can also use the “UP” and “DOWN” arrows.

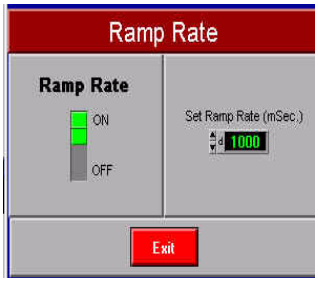


Figure 36: Ramp Rate Screen

When the desired Ramp Rate has been selected, press the “Exit” button to input the setting and return to the Main Menu.

5.6.9 Setpoint Origin Screen

The Setpoint Origin Screen provides a means to select the origin of the Setpoint either through the RS-485, Analog, or DeviceNet Port of the IN2. Selection is accomplished by sliding the arrow on the right side of the screen to the proper selection.

The Setpoint Origin Screen also provides the selection of a delay from the time the setpoint is reached and the flow through the IN2 begins. Type in the desired delay in milliseconds into the box provided or by use of the Up and Down arrows to the left of the box. (If no delay is required, valve is set to zero.) Maximum delay is 3000 m sec. After the selection of the setpoint delay, click anywhere on the screen (except **Exit**) to set the delay time.

Select **Exit** to return to the main menu.

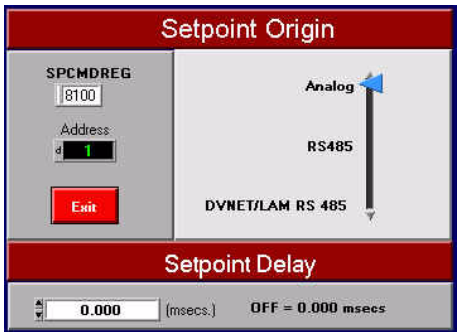


Figure 37: Setpoint Origin Screen

5.6.10 Heated MFC

Celerity offers as an option MFCs for heated environments up to 80 degrees C (delta temperature 60 degrees). For heated MFC applications user must first verify that a heated MFC is installed. Next the desired operating temperature can be configured by the following steps:

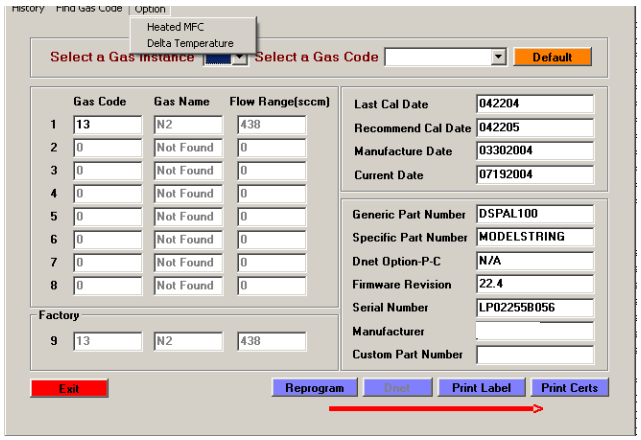


Figure 38: Heated MFC Selection

1. Click **Option** then click **Heated MFC** (see Figure 38).

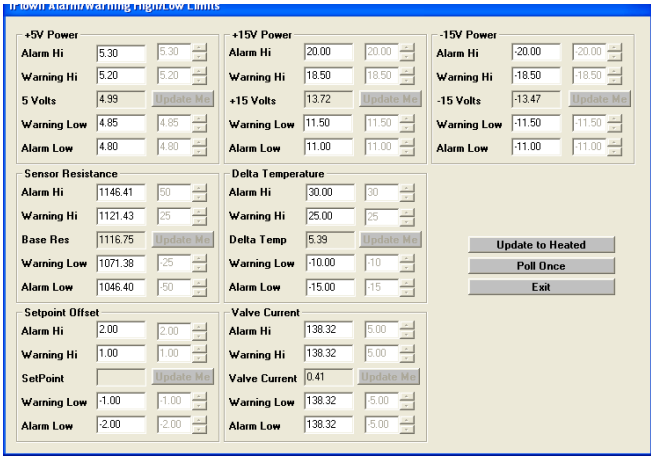


Figure 39: Heated MFC Temperature High and Low Limits

2. Click **Update to Heated** to change unheated MFC to heated MFC.

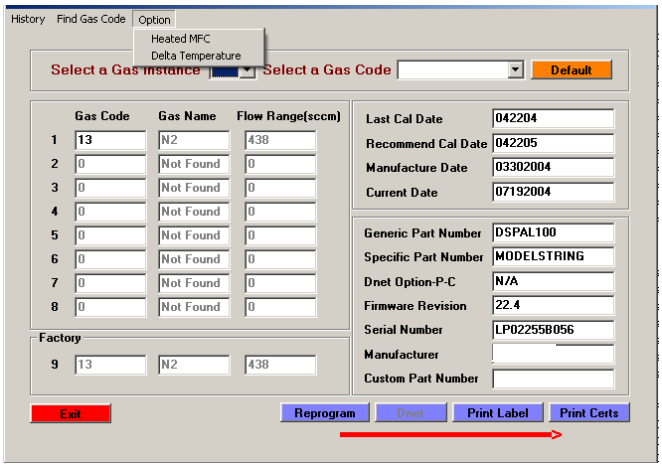


Figure 40: Delta Temperature Selection

After the MFC reflect that it is a heated MFC then:

3. Click **Option** then **Delta Temperature.**

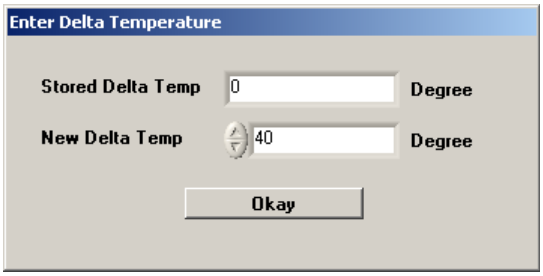


Figure 41: Delta Temperature Entry Screen

4. Enter a Delta Temperature into the above screen.
5. If the MFC is a normal non-heated MFC, the following screen will pop-up whenever **Delta Temperature** is selected under **Option** (See Figure 40).

Figure 42: Non-Heated Device Selected Screen

5.6.11 High Flow MFC

Celerity offers a High Flow model IN2. The High Flow model supports a limited number of calibrated supported gases. The desired calibrated gas is selected as shown by the drop down window of the Select a Gas Code box. The user can re-configure a High Flow MFC the same as a normal MFC but only supported gases can be selected.

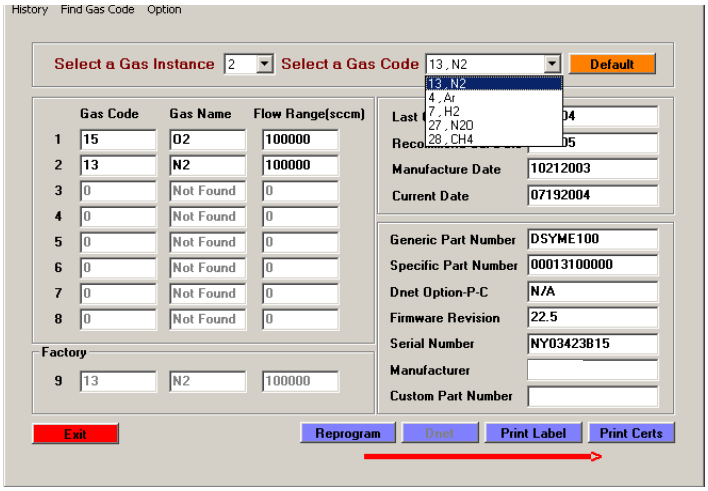


Figure 43: High Flow Configuration Screen

6.0 TROUBLESHOOTING THE SOFTWARE

Table 8: TROUBLESHOOTING SUGGESTIONS

MALFUNCTION	SUGGESTED SOLUTIONS
Program does not communicate with the IN2 MFC	• Check all cable connections to ensure that the connections are tight and properly inserted. • Ensure that the IN2 MFC is receiving power and that the status indicator LED is green. • Verify that the correct serial com port has been selected. • Exit and restart the software to re-establish serial communications with the IN2 MFC.
The software stops functioning (Crashes) during an operation session	• Restart the program. • Restart the computer using the restart procedure recommended by the computer manufacturer and then restart the program.
The program does not communicate with one or more of the IN2 MFCs in the system	• Check the cabling and power to the affected unit. • Check each IN2 controller to ensure that each one has an unique address between 1 and 32.

Table 9: IN2 MFC Electrical Connection Pin-out

DB15HD	DB9	9-Pin "T"	FUNCTION	TYPE	MIN. VOLTAGE	NOMINAL VOLTAGE	MAX VOLTAGE	DC Impedance
1	**7**	**7**	Signal Common	bi-directional		zero Volts		zero ohm
2	**2**	**2**	Indicate Flow Output zero-5V	Output	-0.25 Volts	zero to 5 Volts	5.25 Volts	100 ohm
3	**8**		RS-485 Positive	bi-directional				
4	**9**		RS-485 Negative	bi-directional				
5	**3**	**3**	+15V DC	Input	12 Volts	15 Volts	18 Volts	
6	**5**	**5**	- 15V DC	Input	-18 Volts	-15 Volts	-12 Volts	
7			Auxiliary Input	Input	zero Volts	zero to 10 Volts	10.5 Volts	1M ohm
8	**6**	**6**	Setpoint, zero to 5V	Input	zero Volts	zero to 5 Volts	5.13 Volts	512k ohm
9	**4**	**4**	Power Supply Common	bi-directional		zero Volts		zero ohm
10		**8**	Signal Common	bi-directional		zero Volts		zero ohm
11			+5V DC Reference Out	Output		5 Volts		zero ohm
12	**1**		Valve Voltage, zero to 5 V	Output	zero Volts	zero to 5 Volts	5.27 Volts	100 ohm
13			Purge CMOS Active Low[1]	Input	zero Volts	5 Volts	5 Volts	CMOS
14			Case Ground[2]	bi-directional		zero Volts		
15			Valve Off CMOS Active Low[3]	Input	zero Volts	5 Volts	5 Volts	CMOS
		1[5]	Valve Override[4]	Bi-directional	-15 Volts	zero Volts	+15 Volts	20k ohm
		9	No Connection					

[1] Connect a CMOS Active Low Signal or ground to purge or open valve

[2] Connect a path to earth ground with a low impedance connection

[3] Connect a CMOS Active Low Signal or ground to close or shutoff valve

[4] Valve override functions as follows: connecting pin 1 to the positive supply or +15V DC supply initiates full flow, connecting pin 1 to the negative supply or -15V DC supply disables the valve drive circuit causing the valve to close.

[5] Dual function, also serves as valve current indicator zero to 3.8V DC.

LEAK DETECTION AND CORRECTION PROCEDURE APPENDIX B

NOTE: To ensure that the IN2 MFC is properly installed in the system thoroughly test the system for leaks BEFORE placing the system back on-line.

Use the following procedure to detect and correct a leak:

1. Purge the system with dry nitrogen in accordance with the system manufacturer's directions and specifications. This will remove air, moisture, and contaminants.
2. Close the upstream and downstream shut-off valves and install the IN2 MFC.
3. Ensure that the IN2 MFC control valve is in the open position (electrical connection required).
4. Open the upstream and downstream shut-off valves.
5. Pressurize the system with helium to the setting specified by the system manufacturer.
6. Thoroughly check the plumbing connections and the IN2 MFC for leaks using a calibrated helium leak detector.
7. There are only 2 possible leak locations: the plumbing connections that connect the IN2 MFC to your system and the IN2 unit itself.
   - **Leak Source Confirmation: IN2 unit.** If the leak is coming from the IN2, continue to step 8.
   - **Leak Source Confirmation: plumbing connections.** If the leak is coming from the VCR connectors, tighten the connectors to specifications and retest. If a leak is still detected, continue to step 8.
8. Evacuate the helium from the system.
9. Close the upstream and downstream shut-off valves.
10. Resolve the leak as follows:
    - If the leak was detected in the IN2 unit itself, disconnect the unit, replace it in the protective shipping package, contact Celerity, and arrange to have the unit returned for repair or replacement at Celerity's option. See Appendix K.
    - If the leak was detected in the Surface Line or VCR connectors, disconnect the IN2 MFC and examine the gaskets or seals (that were placed prior to installation). If the gaskets are mispunched, deformed, or damaged, replace them. If:
      -The gaskets are scored, examine the machining on the seal-face(s). If the seal-face surfaces are defective, install new connectors (VCR) or replace Surface Mount IN2.
      -The gasket material itself is not correct for the gas that the IN2 MFC will be controlling. Remove the gasket(s) and reinstall gaskets of the proper material.
11. Reinstall the IN2 MFC.
12. Repeat Step 3 through Step 6.
13. No leaks should be detected if the only two possible leak sources have been corrected. However, if a leak is still detected, contact Celerity for technical assistance.

IN2 MFC TROUBLESHOOTING APPENDIX C

INTRODUCTION

A major advantage of a digital MFC is the capability for enhanced diagnostics. The IN2 MFC incorporates various diagnostics not previously available on analog or “digital/analog” MFC. Diagnostic information is available from the DeviceNet port and the half-duplex RS-485 Interface. The RS-485 port is available on all versions of the IN2 MFC.

Diagnostic data is accessible from the RS-485 Interface via User Software. The program allows users to perform diagnostic tests, execute change gas commands, execute sensor-zero commands, and retrieve both real-time and historical data from IN2. Since these diagnostics can be performed “on tool”, it is possible to reduce tool down time. Muftis can be the source of gas delivery problems for semiconductor process tools; however, MFCs are often removed with “no problem found” during failure analysis. Intelligent digital MFCs with Embedded Diagnostics™ enables customers or field service engineers to diligently identify the most probable cause of failure for the gas delivery system. Proper acquisition and interpretation of the “on tool” data using Celerity Software can facilitate increased uptime, root cause analysis and corrective action with respect to the gas delivery system for the process tool.

Real-time data such as indicated flow, valve current, and setpoint can be retrieved from IN2 MFC while the unit is controlling gas flow on the process tool. Historical data such as time and gas flow totalizers can also be retrieved. The program also allows the user to display a continuous real-time trace of indicated flow, valve current, and setpoint and save this data to a file for subsequent analysis.

Together, the IN2 MFC Embedded Diagnostic features and software provide the user with the necessary tools to solve gas delivery issues on-tool, thereby reducing tool down time and improving cost of ownership

GENERAL TROUBLESHOOTING

IN2 MFC troubleshooting can be done while the unit is still installed in the gas delivery system of the process tool or in a laboratory that is equipped to test Digital MFC. Celerity supplies a PC based application or software, which facilitates diagnostics.

The objective of on-tool troubleshooting is to accurately determine the real time status of the digital MFC, without having to remove the IN2 from the tool, thereby improving tool availability and improving the quality of the failure analysis, Off-tool diagnostics allow for a more complete evaluation of the unit. In this case, Embedded Diagnostic data along with actual flow data can be observed to better determine IN2 status. Laboratory or off-tool diagnostics require certified or primary flow standards whenever it is necessary to evaluate the accuracy of the actual or real gas calibration. This document describes troubleshooting procedures to identify digital MFC related issues.

⚠ CAUTION ⚠

Prior to performing troubleshooting operations or maintenance on the IN2 MFC, ensure that the IN2 has been properly installed according to the instructions found in the installation section of this manual. Check with facility safety personnel, tool owner, and manufacturing coordinator prior to performing tests or maintenance on

the IN2. The system in which the IN2 is installed may contain a process gas that is EXPLOSIVE, CORROSIVE, or COMBUSTIBLE. make sure that all facility safety procedures are followed during operation, maintenance, or testing of the IN2 MFC.

VERIFY UNIT POWER AND INTITIALIZATION

When power is applied, the IN2 MFC performs a self-diagnostic routine and indicates its status through bi-color LEDs. IN2 MFCs configured to accept an analog setpoint have only a Module status LED. IN2 MFCs configured to interface to DeviceNet enabled process tools have Module (MOD) and Network (NET) Status LEDs for DeviceNet MOD and NET LEDs. Refer to Table 11.

Table 10: ANALOG LED CHARACTERISTICS

LED STATE	PROBLEM	SOLUTION
Off	No power to the unit	Check power supply and connections
Green	Unit is operating normally	No corrective action required
Flashing Red	Recoverable error	Consult Celerity's Technical Service
Solid Red	Unrecoverable error	Unit may require repair

DEVICENET POWER UP SEQUENCE APPENDIX D

Applying power to a DeviceNet IN2 MFC initiates a power-up sequence that initializes the embedded mass flow control system along with performing a Module and Network test. The real time status of these tests is indicated on the Module and Network LEDs on the top of the IN2.

After power is applied, the IN2 MFC flashes the Module and Network LEDs according to the following sequence. If this sequence does not occur, a problem exists with module power or with the IN2 itself.

Module LED Power-up Sequence: Off, **Green** (250 mSec), **Red** (250 mSec).

Network LED Power-up Sequence: Off, **Green** (250 mSec), **Red** (250 mSec).

After the LED flash sequence has completed, the Module and Network LEDs will display the real time status of the Module and Network respectively. The following tables describe the status LED behavior

Table 11: DeviceNet MODULE (MOD) LED

LED STATE	PROBLEM	SOLUTION
Off	Power off	No power applied to the device
Flashing Green-Red	Device self-test	Device is in self-test. The DeviceNet specifications defines blink rates and patterns for the Module Status LED during self-test
Green	Unit is operating normally	No corrective action required
Red	Unrecoverable fault	Device has detected an unrecoverable fault

Table 12: DeviceNet NETWORK (NET) LED

LED STATE	PROBLEM	SOLUTION
Off	Power off	No power applied to the IN2
Flashing Green-Red	IN2 self-test	IN2 is in self-test.
Flashing Green	On-line, not connected	IN2 is operating normal. It is on-line but no connection has been established
Green	On-line, connected	IN2 is operating normal. It is on-line and one or more connections are established
Flashing Red	Connection time out	One or more connections have timed out
Red	Unrecoverable fault	IN2 cannot communicate on the network (Duplicate Macld or Bus-off condition)

DEVICENET MFC AND NETWORKING ISSUES AND SOLUTIONS

There are a number of initialization failure scenarios that can occur with DeviceNet MFCs. These issues include wrong “produced” and “consumed” paths, incorrect address or baud rate settings, network wiring, network termination, and network power supply problems. Several of the more common initialization problems are:

Power-up LED Sequence Fails. If the Module or Network LEDs fail to sequence from OFF to Red to Green as previously described, there is either a network power supply problem or the IN2 has most likely experienced an unrecoverable fault. The corrective action is to verify that the power supply is providing 11 to 24 volts to the DeviceNet network on the correct cable conductors. If the power supply voltage is properly applied and the LEDs do not sequence correctly, the IN2 should be returned to the Celerity service center.

Sequence Passes, Module LED Turns Red. If the normal LED flash sequence completes and the Module LED then turns Red, there is a problem with the embedded flow control system. Return the IN2 to the Celerity service center.

Sequence Passes, Module LED is Green, Net LED is Red. This situation will occur if there is another IN2 on the network with the same MACID or address. The Network LED will turn Red if the IN2 initializes after another IN2 has already initialized itself with the same MACID. The first IN2 that “claims” the MACID will initialize correctly, but subsequent IN2s will not be able to initialize with the same MACID. The solution is to select a unique MACID for each IN2. Note that the embedded control system reads the MACID (address) and baud rate switches only once during initialization after power is applied. (See Figure 18:, Typical Rate and Address Switches Location, for Baud and MACID switches)
In some cases, the Network LED may display Red due to a baud rate error. Also, verify that the baud rate of the IN2 matches that of the network. If it is necessary to change the address or baud rate, then remove and reapply power to the IN2.
Sequence Passes, Module LED is Green, Net LED is Off. This problem will occur if the baud rate of the IN2 is not the same as the baud rate of the other IN2s on the network. Set the IN2 baud rate to the correct value and power cycle the IN2 as described above.
Sequence Passes, Module LED is Green, Net LED is Flashing Green. This situation indicates that the IN2 is working properly and that there are no MACID or Baud Rate conflicts. The flashing Green Net LED indicates that the IN2 “sees” a valid network and it is waiting for the tool controller or scanner to establish logical connection(s). Logical connections enable the process tool controller to set or get variable or assemblies of data such as setpoint and indicated flow.

The following table lists trouble clearing messages, their meaning and what to check.

Table 13: TROUBLESHOOTING MESSAGES

MESSAGE	WHAT IT MEANS	WHAT TO CHECK
5.0V supply short	The internal 5.0V supply has shorted causing an overheat condition.	The IN2 MFC unit will require repairs at a Celerity Service Center.
Excessive overshoot	The IN2 MFC has detected an out-of-specification overshoot on a setpoint change.	Check gas instance.
High inlet pressure	The IN2 MFC has detected a high inlet or upstream pressure which may interfere with flow control.	Reduce inlet pressure to a value within the IN2 MFC specifications.
IN2 MFC overheat	The IN2 MFC has detected a high internal temperature.	Ensure that the IN2 MFC’s case has adequate air circulation and is located away from heat sources.
Low inlet pressure	The IN2 MFC has detected a low inlet or upstream pressure which may interfere with flow control.	Increase inlet pressure to a value within the IN2 MFC’s specifications.
Negative supply over voltage	The IN2 MFC has detected a high voltage on the negative supply rail.	Reduce the absolute value of the negative supply voltage.
Negative supply short	The negative supply is shorted causing an overheat condition.	The IN2 MFC unit will require repair at a Celerity Service Center.

Table 13: TROUBLESHOOTING MESSAGES (Continued)

MESSAGE	WHAT IT MEANS	WHAT TO CHECK
Negative supply under voltage	The IN2 MFC has detected a low voltage condition on the negative supply rail.	Increase the absolute value of the negative supply voltage.
Positive supply over voltage	The IN2 MFC has detected a high voltage condition on the positive supply rail.	Reduce the absolute voltage of the positive supply voltage.
Positive supply short	The positive supply is shorted causing an overheat condition.	The IN2 MFC unit will require repairs at a Celerity Service Center.
Positive supply under voltage	The IN2 MFC has detected a low voltage condition on the positive supply rail.	Increase the absolute value of the positive supply voltage.
Purge Mode enabled	Purge Mode has been activated by an external command to the IN2 MFC analog control pins, via RS-485, or DeviceNet command.	If Purge Mode is not desired, disconnect the purge control pin from ground.
Sensor bypass plugged	Foreign material is restricting the flow of gas through the sensor bypass, causing a low out-of-calibration flow rate.	Visual inspection may confirm the presence of foreign material or corrosion in the IN2 MFC's gas tube.
Sensor disconnect/ Sensor overheats	The flow sensor is overheating or has become disconnected causing an out-of-calibration flow rate.	Ensure that the IN2 MFC's case has adequate air circulation and is located away for heat sources.
Sensor overheat	The sensor temperature is high, causing out-of calibration flow rate.	Ensure that the IN2 MFC's case has adequate air circulation and is located away for heat sources.
Sensor plugged	Foreign material is restricting the flow of gas through the sensor capillary tube, causing a high out-of-calibration flow rate.	Visual inspection may confirm the presence of foreign material or corrosion in the IN2 MFC's gas tube.
Sensor shorted	One or both of the sensor windings is shorted, causing increased no-flow offset and flow control errors.	The IN2 MFC unit will require repairs at a Celerity Service Center.
Solenoid disconnected	One or more of the solenoid leads are disconnected or the solenoid windings are broken, preventing the valve from operating	The IN2 MFC unit will require repair at a Celerity Service Center.
Solenoid shorted	The valve solenoid winding is shorted, preventing the valve from operating.	The IN2 MFC unit will require repair at a Celerity Service Center.
Steady state flow error	The IN2 MFC has failed to achieve the desired setpoint.	Check inlet pressure and isolation valves, and verify that the process matches the calibration gas.
Valve drive electronics failed "ON"	The valve is fully energized and is NOT controlling the flow of gas.	The IN2 MFC unit will require repairs at a Celerity Service Center.
Valve stuck closed or insufficient travel	Corrosion or foreign material in the valve mechanism has limited valve travel, preventing the IN2 MFC from reaching the desired setpoint.	Visual inspection may confirm the presence of foreign material or corrosion in the IN2 MFC's gas tube, or excessive heat may have caused the valve solenoid to seize.

Table 13: TROUBLESHOOTING MESSAGES (Continued)

MESSAGE	WHAT IT MEANS	WHAT TO CHECK
Valve stuck open or leaking	Valve cannot close fully due to corrosion or foreign material on the valve ball or seat assembly.	Visual inspection may confirm the presence of foreign material or corrosion in the IN2 MFC's gas tub.

Table 14: ANALOG OUTPUT

PERCENT FULL-SCALE	DEVICENET SETPOINT	DEVICENET INDICATED FLOW	ANALOG OUTPUT (VOLTAGE)
zero	zero Hex	zero Hex	zero V
25.0	1800 Hex	1800 Hex	1.0V
50.0	3000 Hex	3000 Hex	2.5V
100.0	6000 Hex	6000 Hex	5.0V

PARAMETERS	ZERO VALUE
V+ Monitor, Volts	15
V- Monitor, Volts	15
5V Monitor, Volts	5
Temperature, C	Determined during calibration
Valve Current, mA	zero
Base Resistance, ohm	Determined during calibration
OP - SP,% scalea_d=7FFFh[2]	zero
OP - SP,% scalea_d=6000h[2]	zero

Table 15: ALARM LIMITS - SETPOINTS BASED ON ZEROED VALUES

HIGH WARNING	LOW WARNING	HIGH ALARM	LOW ALARM
DELTA	DELTA	DELTA	DELTA
3.5	-3.5	5	-4
3.5	-3.5	5	-4
0.2	-0.15	0.3	-.02
25	-10	30	-15

NOTE 1: Allow 2.5 seconds settling time after setpoint change before tripping OP-SP warning or alarms.

NOTE 2: Valve current alarms and warnings are independent on setpoint. Logic to be determined.

HIGH WARNING	LOW WARNING	HIGH ALARM	LOW ALARM
DELTA	DELTA	DELTA	DELTA
25	-25	50	-50
1	-1	2	-2
1-1	2	2	-2

NOTE 1: Allow 2.5 seconds settling time after setpoint change before tripping OP-SP warning or alarms.

NOTE 2: Valve current alarms and warnings are independent on setpoint. Logic to be determined.

Table 16: DeviceNet Cables

CABLE	LENGTH	BAUD RATE	DROP-LENGTH (Maximum Meters)	DROP-LENGTH (Cumulative Meters)
$L_{thick} + 5\ L_{thin}$	500	125k	6	156
$L_{thick} = 2.5_{thin}$	250	250k	6	78
$L_{thick} + 5\ L_{thin}$	100	500k	6	39

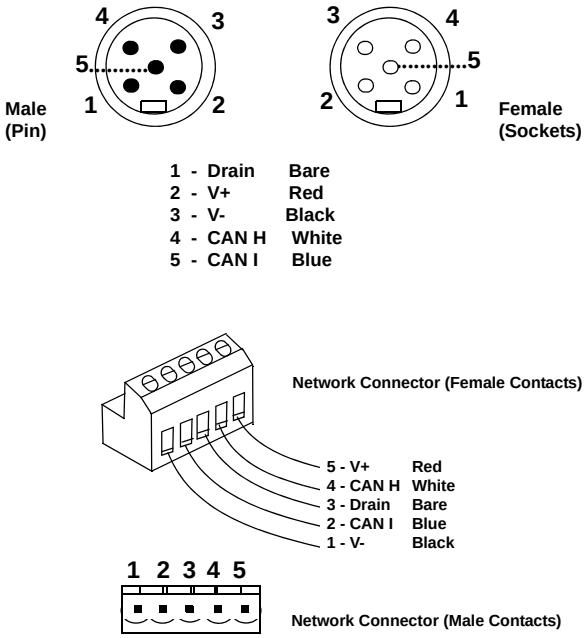


Figure 44: DeviceNet Connector

NOTE: The following is referenced in the DeviceNet Installation Manual:

Thick Cable

This cable consists of two shielded pairs twisted on a common axis with a drain wire in the center covered with an overall braid shield and is commonly used as trunk line when length is important.

Listed below are general requirements for the DeviceNet Thick Cable. Other types of external insulation and/or jacketing are allowable provided that internal construction and electrical characteristics adhere to the cable specifications. (For details, see Table A on page 43.)

One twisted signal pair (#18); blue/white

One twisted power pair (#15); black/red

Separate aluminized mylar shields around power pair and signal pair

Overall foil/braid shield with drain wire (#18); bare*

High speed (Vp = 75% min.), low loss, low distortion, data pair (to keep propagation delays to a minimum)

8 amp maximum current capacity

PVC insulation on power pair

Industrial temperature range

High flexibility

* The drain wire connects the shields within the cable and serves as a means to terminate the shield into the connector.

Thin Cable

Thin Cable is smaller and more flexible than Thick Cable. It is commonly use for drop lines but can also be used (for shorter distances) as trunk line.

Listed below are general requirements for the DeviceNet Thin Cable. Other types of external insulation and/or jacketing are allowable provided that internal construction and electrical characteristics adhere to the cable specifications. For details, see Appendix D**,** rewiring.

- One twisted signal pair (#24); blue/white
- One twisted power pair (#22); black/red
- Separate aluminized mylar shields around power pair and signal pair
- Overall foil/braid shield with drain wire (#22); bare*
- High speed (Vp = 75% min.), low loss, low distortion, data pair (to keep propagation delays to a minimum)
- 3 amp maximum current capacity
- PVC insulation on power pair
- Industrial temperature range
- High flexibility

* The drain wire connects the shields within the cable and serves as a means to terminate the shields into the connector.

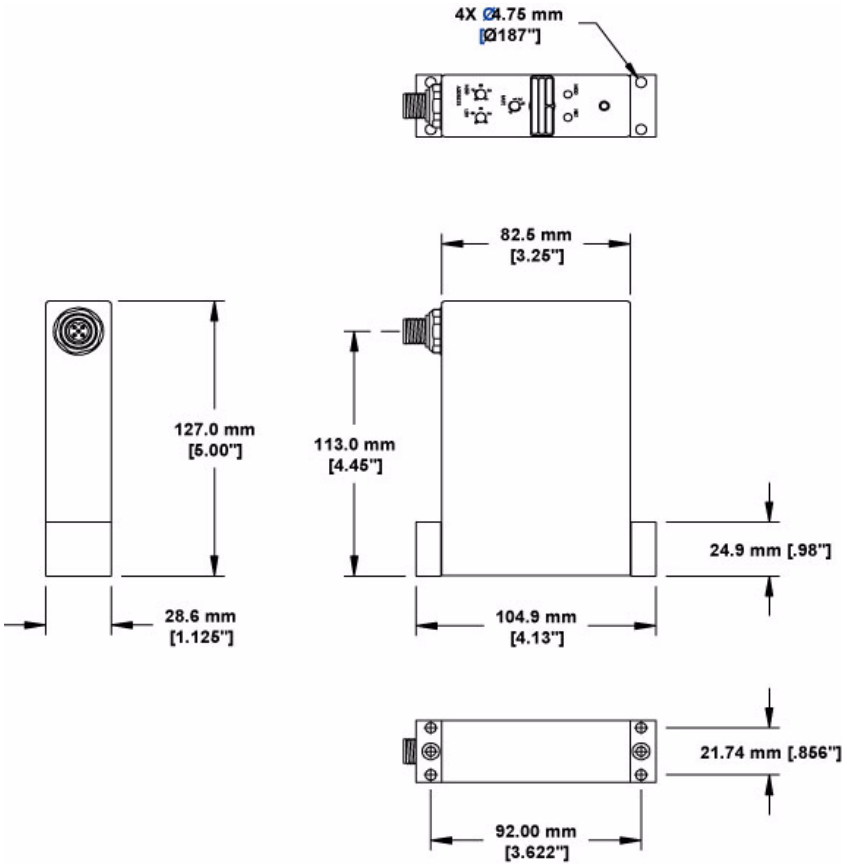
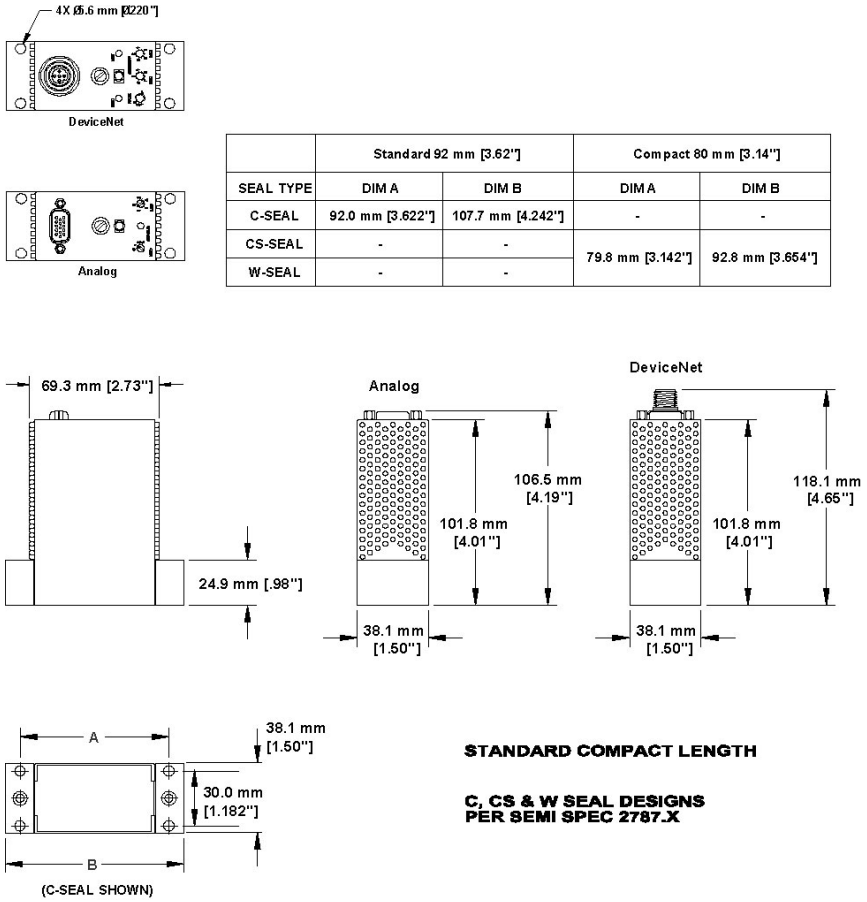
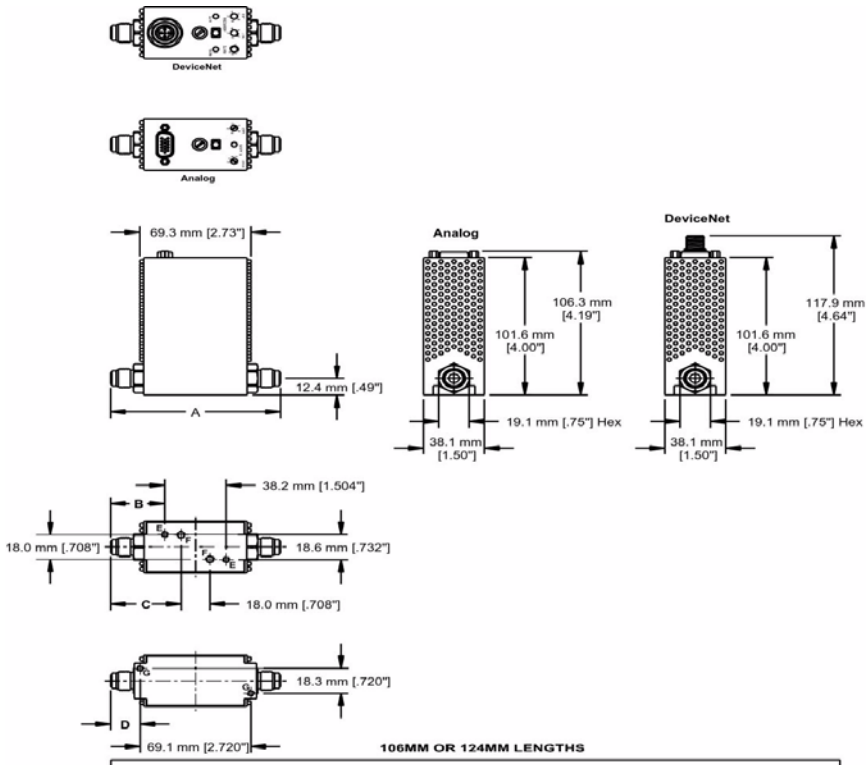


Figure 45: 1.125” Surface Mount Dimensions



	Standard 92 mm [3.62"]		Compact 80 mm [3.14"]	
SEAL TYPE	DIM A	DIM B	DIM A	DIM B
C-SEAL	92.0 mm [3.622"]	107.7 mm [4.242"]	-	-
CS-SEAL	-	-	79.8 mm [3.142"]	92.8 mm [3.654"]
W-SEAL	-	-		

Figure 46: 1.5” Surface Mount Dimensions



106MM OR 124MM LENGTHS

DIMENSIONS							
LENGTH	A	B	C	D	E	F	G
106 mm	106.0 mm [4.173"]			18.5 mm [.726"]			
124 mm	124.0 mm [4.882"]	42.9 mm [1.689"]	53.0 mm [2.09"]	27.5mm [1.081"]	M4 X 0.7-6H	M5 X 0.8-6H SEMI SPEC	8-32 UNC-2B TYLAN 2900

Figure 47: 38.1mm (1.5”) X 106mm and 124mm Dimensions

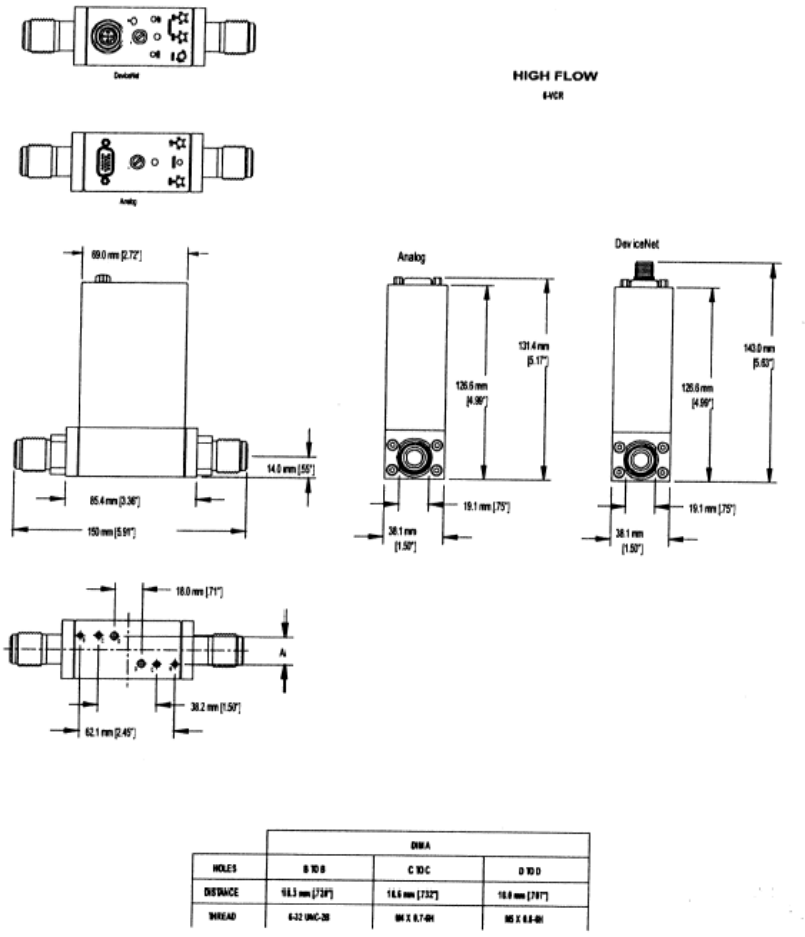
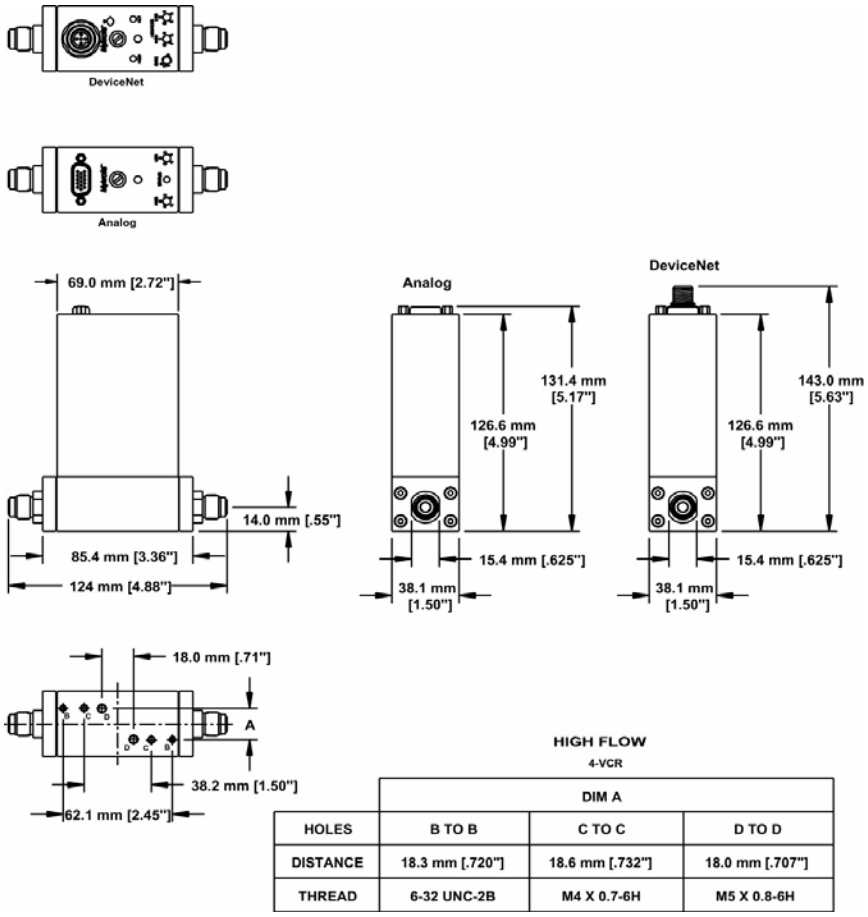


Figure 48: IN2 6-VCR High Flow



HIGH FLOW
4-VCR

	DIM A		
HOLES	B TO B	C TO C	D TO D
DISTANCE	18.3 mm [.720"]	18.6 mm [.732"]	18.0 mm [.707"]
THREAD	6-32 UNC-2B	M4 X 0.7-6H	M5 X 0.8-6H

Figure 49: 1.5” 4VCR High Flow Dimensions

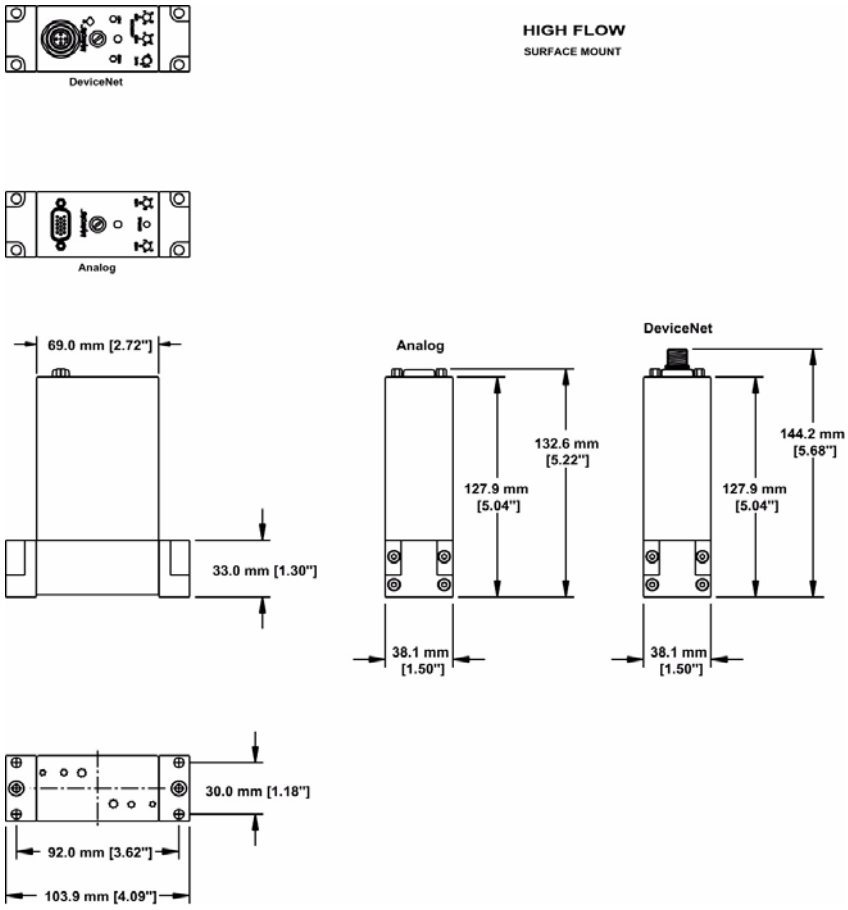
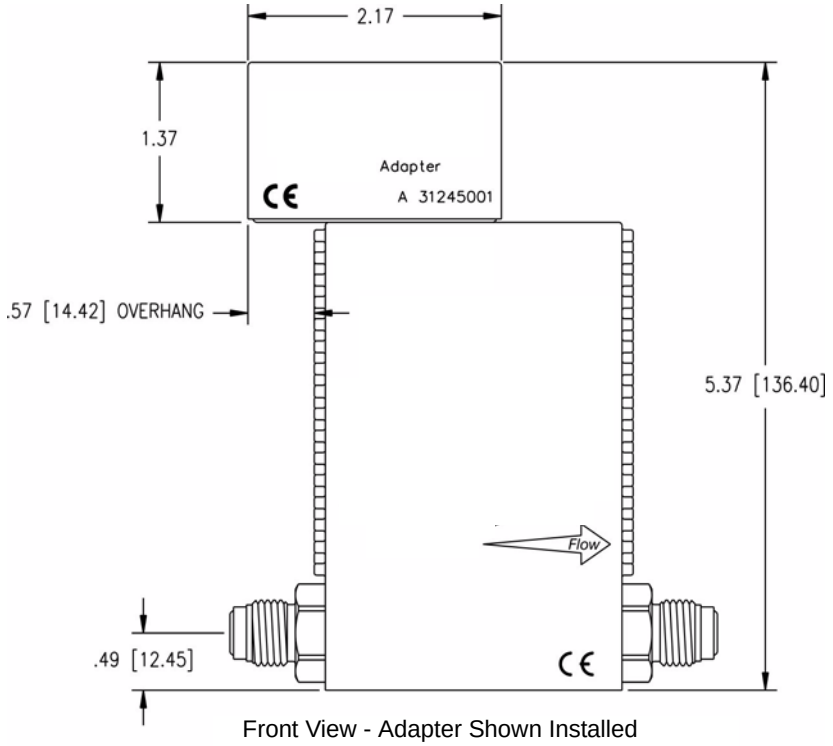


Figure 50: 1.5” High Flow Surface Mount Dimensions



Front View - Adapter Shown Installed

Figure 51: Electrical Adapter Dimensions

Protocol

IN2 communications hardware implements a half-duplex or two-wire RS-485 network, which is intended to work with one master and one to 31 slave IN2s. A rotary switch located on each IN2 selects a unique node address. The host or master PC will be assigned a node address of zero, while the IN2s will occupy unique address from 01 to $1F_{hex}$.

Communication Port Settings

Communication settings are fixed at 9600 bits per second (bps), no parity, eight data bits, and one stop bit. Approximately 960 characters per second can be transmitted over the channel. Fixed communications port settings simplifies the design of the IN2 and host software without compromising functionality.

Host and IN2 Address Requirements

The host address is required to be zero or “0”. IN2 addresses must be within the range of 01 to FF_{hex}; however, it is recommended that the IN2s addresses use range 01 to $1F_{hex}$. The number of nodes on an RS-485 network is limited to 32.

Protocol Specifications

The following message format provides general capabilities to address multiple nodes, pass commands and data to the IN2s on the network, and allows for error checking. Figure 52 shows the message structure. All message fields, except for the STX Start Char and the ETX End Char contain printable ASCII characters.

	Start Char	Source Address	Destination Address	Message Command	Number of Bytes	Application Command/ Data	Check Sum	End Char
No. Bytes	1	2	2	2	2	0 to 255	2	1
Char Data	STX	“00”	“01”	“01”	“07”	“84 6000”	“0D”	ETX
Hex Data	02	30 30	30 31	30 31	30 37	38 34 20 36 30 30 30 30	30 44	03

Figure 52: Protocol Message structure

Start Character

A Start Character, STX (02), is always precedes the message. The Start and End Characters are unique values, and will not appear anywhere else in the message body.

Source Address

This field contains the address of the master or slave sending the message. The address is represented in ASCII/HEX format. Two ASCII characters are used to represent the binary value of the source address. Valid ASCII characters for the

source address are “0”-”9” and “A”-”F”, with values of 30_{hex} and 41_{hex} to 46_{hex} respectively. In Figure 52:, Protocol Message structure, the source address contains two ASCII “0” characters, which represents the binary value of zero.

Destination Address

This field contains the address of the master or slave for which the message is intended, also in ASCII/HEX format.

Message Command

The Message Command specifies the type of message that is being sent. It also conveys to the node if a response is required or not. Broadcast or point-to-point messages can be defined. Other message types will be defined as the need arises. The field does NOT specify the command intended for the destination’s application. Format is ASCII/HEX. Valid values of Message Command are shown in.Figure 53

Message Command Value	Meaning
“00”	Point-to-point message. No response allowed.
“01”	Point-to-point message. Response required.
“02” through “FD”	Reserved for future use.
“FE”	Broadcast message. Response required. Do NOT use this command if more than one IN2 is connected to the network! See explanation below. Currently, IN2 does not support Broadcast Messages
“FF”	Broadcast Message. No response allowed

Figure 53: Message Command Field

A Message Command value of “FE is used to determine the address of a IN2 whose address is not known. This broadcast message requires a response, meaning that any IN2 on the network will respond to this message. For this reason, the “FE” Message Command should not be used if more than one IN2 is connected to the network.
A Message Command value of “FF” is a Broadcast Message that does not require a response. Any number of IN2s can be connected to the network when “FF” Messages are broadcast. Currently, IN2 does not implement any Broadcast Messages.

ELECTRICAL ADAPTERS APPENDIX H

Scope

These instructions give details of how the electrical DIP switches found on the electrical connector adaptors used on Celerity IN2 MFCs and meters should be set prior to installation. Parts covered include Celerity part numbers A330204001, A330204002, A330204003, A330204004 and A331245001.

Information Needed Before Setting Switches

Prior to setting the adaptor's DIP switches, the user should have available the following information:

- Exact manufacturer name and model number of flow control product that is being replaced by IN2 MFC.
- Use of nonstandard functions that previous flow control product provided, such as use of high/low alarms, ramped flow control, and etc.

Switch Function and Location

All IN2 MFC electrical adaptors are designed to adapt the standard 15-pin high-density D-subminiature male connector on top of the IN2 MFC to common connectors used on other flow control products from several manufacturers. Each adaptor has four (4) dual-inline package (DIP) switches on its bottom surface that must be set prior to installation of the adaptor on top of the IN2 MFC. To access these switches, turn the adaptor over so that the female 15-pin D-subminiature plug is facing as shown in Figure 54.

Settings for Card Edge Adaptor P/N A330204001

If the existing flow control device in the process system uses the 20-pin card edge connectors, use Table 17 below to determine the proper settings for the DIP switches so that the device Digital MFC functions correctly in the system:

Table 17: DIP SWITCH SETTINGS FOR CARD EDGE CONNECTOR

Existing Flow Control Device Manufacturer and Product	TN26xx or TN29xx Products	Aera® Model 780 or 980	Celerity Unit Instruments UFC-11xx or 16xx Product (except 1665)
Switch A Position	Ground	Ground	Ground
Switch B Position	"T"	"T"	"T"
Switch C Position	Press In	Valve Signal	Press In
Switch D Position	Switch C	Switch C	Switch C

NOTE: This adaptor does not support special MFC functions such as soft-start and sensor output.

Settings for 9-Pin D-Subminiature Adaptor P/N A330204002

If the existing flow control device in the process system uses the 9-pin D-subminiature connectors, use Table 18 below to determine the proper settings for the DIP switches so that the device Digital MFC functions correctly in the system:

Table 18: DIP SWITCH SETTINGS FOR 9-PIN D-SUBMINATURE ADAPTER

Existing Flow Control Device Manufacturer and Product	TN29xx Products	Celerity Unit UFC-11xx and 16xx (except 1665)	Horiba®/STEC® model 3xxx and 4xxx	Horiba/STEC model 74xx
Switch A Position	Ground	Ground	Ground	Valve Signal
Switch B Position	“T”	Valve Off	“T”	“T”
Switch C Position	Press In	Valve Signal	Press In	Press In
Switch D Position	Switch C	Switch C	Switch C	Switch C

Settings for 15-Pin D-Subminiature Adaptor P/N A330204003

If the existing flow control device in the process system uses the 15-pin D-subminiature connectors, use Table 19 below to determine the proper settings for the DIP switches so that the device DFC functions correctly in the system:

Table 19: DIP SWITCH SETTINGS FOR 15-PIN D-SUBMINATURE ADAPTER

Existing Flow Control Device Manufacturer and Product	**Celerity®/Mykrolis®/ Millipore®/Tylan®** FC-29xx	Unit UFC-11xx and 16xx (except 1665
Switch A Position	Ground	Ground
Switch B Position	“T”	“T”
Switch C Position	Press In	Press In
Switch D Position	Switch C	Switch C

Settings for 20-Pin “Honda” Adaptor P/N A330204004

If the existing flow control device in the process system uses the 15-pin D-sub-miniature connectors, use Table 20 below to determine the proper settings for the DIP switches so that the device Digital MFC functions correctly in the system.

Table 20: DIP SWITCH SETTINGS FOR “HONDA’ ADAPTER

Existing Flow Control Device Manufacturer and Product	Celerity TN29xx	Aera Model 780 or 980
Switch A Position	Ground	Ground
Switch B Position	“T”	“T”
Switch C Position	Press In	Press In
Switch D Position	Switch C	Switch C

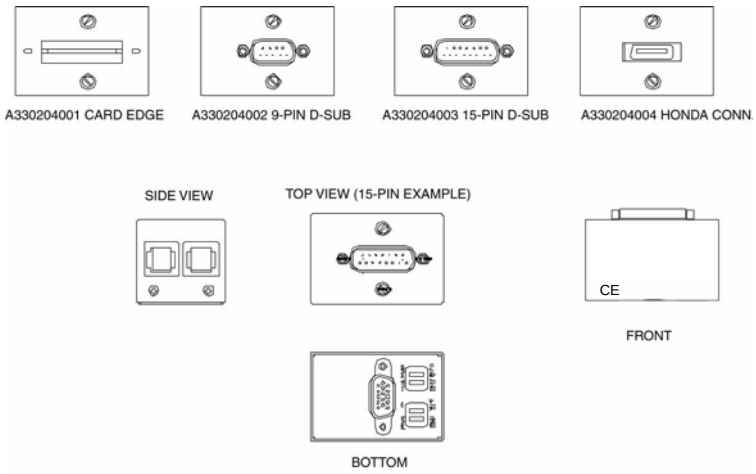


Figure 54: Electrical Adapters Drawings

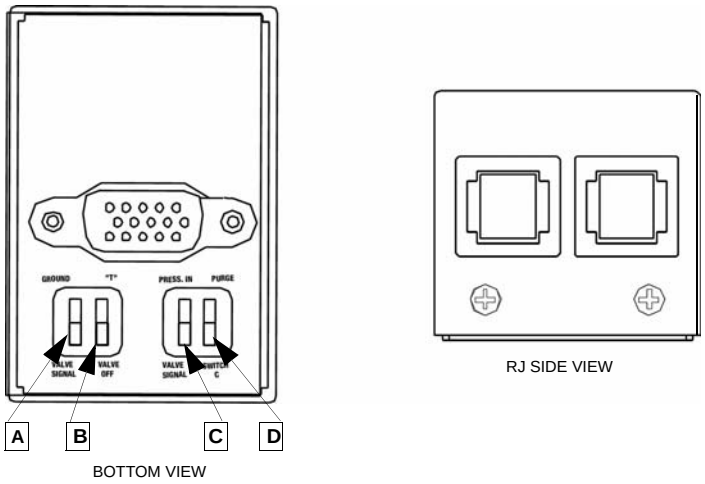


Figure 55: Adapter DIP Switch Layout

CARD EDGE ADAPTER (-001)

FUNCTION	PIN NO.	PIN NO.	FUNCTION
Case Ground	**1**	**A**	Setpoint Input, 0-5V
Ground	**2**	**B**	Ground
Flow Signal, 0-5V	**3**	**C**	Ground
Positive Power Supply	**4**	**D**	Switch B
NC	**5**	**E**	NC
Switches C and D	**6**	**F**	Negative Power Supply
NC	**7**	**H**	NC
NC	**8**	**J**	NC
NC	**9**	**K**	NC
NC	**10**	**L**	Valve Off (When Grounded)

Figure 56: Cardedge Adapter A330204001 Pin Out

DB9, (9-Pin) ADAPTER (-002)

PIN NO.	FUNCTION
1	Switch B
2	Flow Signal, 0-5V
3	Positive Power Supply
4	Ground
5	Negative Power Supply
6	Setpoint Input, 0-5V
7	Ground
8	Switch A
9	Switches C and D

Figure 57: DB9, (9-Pin) Adapter A330204002 Pin Out

DB15, (15-Pin) Adapter (-003)

PIN NO.	FUNCTION
1	Ground
2	Flow Signal, 0-5V
3	NC
4	NC
5	Positive Power Supply
6	Negative Power Supply
7	NC
8	Setpoint Input, 0-5V
9	Ground
10	Ground
11	5V Reference
12	Switch B
13	NC
14	Switch A
15	Valve Off (when Grounded)

Figure 58: DB15, (15-Pin) Adapter A330204003 Pin Out

HONDA 20-PIN ADAPTER (-004)

FUNCTION	PIN NO.	PIN NO.	FUNCTION
Case Ground	1	A	Ground
Ground	2	B	Flow Signal, 0-5V
Flow Signal, 0-5V	3	C	Valve Open/Close (When Connected to V+, V-)
Positive Power Supply, V+	4	D	NC
NC	5	E	Positive Power Supply
Valve Current Signal, 0-5V	6	F	Negative Power Supply, V-
NC	7	H	NC
NC	8	J	NC
NC	9	K	NC
NC	10	L	Valve Off

Figure 59: Honda 20-Pin Adapter A330204004 Pin Out

"L" Adapter

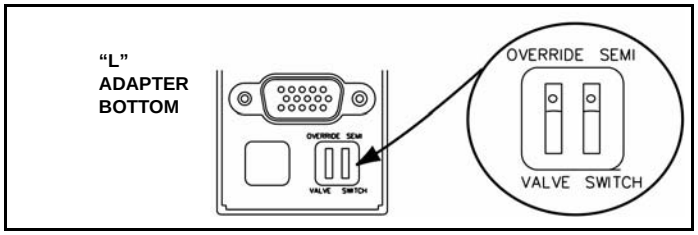


Figure 60: "L" Adapter Bottom View with Default Switch Setting Shown

"L" Card Edge Adapter DIP Switch Setting With SEMI/OVERRIDE Selected

FUNCTION	PIN NO.	PIN NO.	FUNCTION
Case Ground	1	A	Setpoint Input 0-5V DC
Ground	2	B	Ground
Flow Signal, 0-5V	3	C	Ground
+15V DC Supply	4	D	+15V DC Purge/-15V DC Valve OFF[1]
Pressure Input	5	E	NC
+5V DC Precision Reference	6	F	-15V DC Supply
NC	7	H	NC
NC	8	J	NC
NC	9	K	NC
Ground	10	L	NC

[1] When floating, pin D carries a voltage proportional to valve drive level, ranging from about 1-4 volts. If pin D is connected to the positive supply rail (pin 4), the valve is placed in purge condition (fully open). If pin D is connected to the negative supply rail (pin F), the valve is closed (de-energized) regardless of setpoint.

Figure 61: "L" Card Edge Adapter A331245001 Pin-Out (1 0f 4)

"L" Card Edge Adapter DIP Switch Setting With SEMI/VALVE Selected

FUNCTION	PIN NO.	PIN NO.	FUNCTION
Case Ground	1	A	Setpoint Input 0-5V DC
Ground	2	B	Ground
Flow Signal, 0-5V	3	C	Ground
+15V DC Supply	4	D	Valve Drive Signal, 0-5V DC
Pressure Input	5	E	NC
+5V DC Precision Reference	6	F	-15V DC Supply
NC	7	H	NC
NC	8	J	NC
NC	9	K	NC
Ground	10	L	NC

Figure 62: "L" Card Edge Adapter A331245001 Pin-Out (2 0f 4)

"L" Card Edge Adapter DIP Switch Setting With SWITCH/OVERRIDE Selected			
FUNCTION	**PIN NO.**	**PIN NO.**	**FUNCTION**
Case Ground	**1**	**A**	Setpoint Input 0-5V DC
Ground	**2**	**B**	Ground
Flow Signal, 0-5V	**3**	**C**	Ground
+15V DC Supply	**4**	**D**	Purge Mode When Grounded[1]
Pressure Input	**5**	**E**	NC
+5V DC Precision Reference	**6**	**F**	-15V DC Supply
NC	**7**	**H**	NC
NC	**8**	**J**	NC
NC	**9**	**K**	NC
Ground	**10**	**L**	NC

[1] Connect pin D to ground to initiate purge mode (valve fully OPEN)

Figure 63: "L" Card Edge Adapter A331245001 Pin-Out (3 0f 4)

"L" Card Edge Adapter DIP Switch Setting With SWITCH/VALVE Selected			
FUNCTION	**PIN NO.**	**PIN NO.**	**FUNCTION**
Case Ground	**1**	**A**	Setpoint Input 0-5V DC
Ground	**2**	**B**	Ground
Flow Signal, 0-5V	**3**	**C**	Ground
+15V DC Supply	**4**	**D**	Valve Drive Signal, 0-5V DC
Pressure Input	**5**	**E**	NC
+5V DC Precision Reference	**6**	**F**	-15V DC Supply
NC	**7**	**H**	NC
NC	**8**	**J**	NC
NC	**9**	**K**	NC
Ground	**10**	**L**	NC

Figure 64: "L" Card Edge Adapter A331245001 Pin-Out (4 0f 4)

KITS AND ACCESSORIES APPENDIX I

Field Kit Part Number A332293001

The IN2 field kit provides a complete solution for on-tool programming of the IN2. This kit allows programming gas type and range, printing labels and performing full diagnostics. Field kit includes:

- IN2 user software,
- Interface cables and adapters,
- Remote power supply and,
- Portable thermal printer and labels.

See Figure 65 for illustration.

Interface Kit Part Number A332293002

The IN2 Interface Kit provides software and cabling to perform on-tool diagnostic analysis. It includes:

- IN2 user software,
- Interface cables (2.5mm and RJ-11 to DB9 Connectors), and
- RS-232 RS-485 Converter.

DeviceNet Kit Part Number A332293004

- DeviceNet connector to DB9 communications cable,
- Card, PCMCIA, and
- Junction, VB2.

See Figure 66 for illustration

Electrical Adapters

Electrical Adapters and cables for the tool interface include.

- **Card Edge** Part Number A330204001
- **9-Pin** Part Number A330204002
- **15-Pin** Part Number A330204003
- **20-Pin (Honda)** Part Number A330204004
- **Analog** Part Number A331017001
- **“L” Card Edge** Part Number A331245001

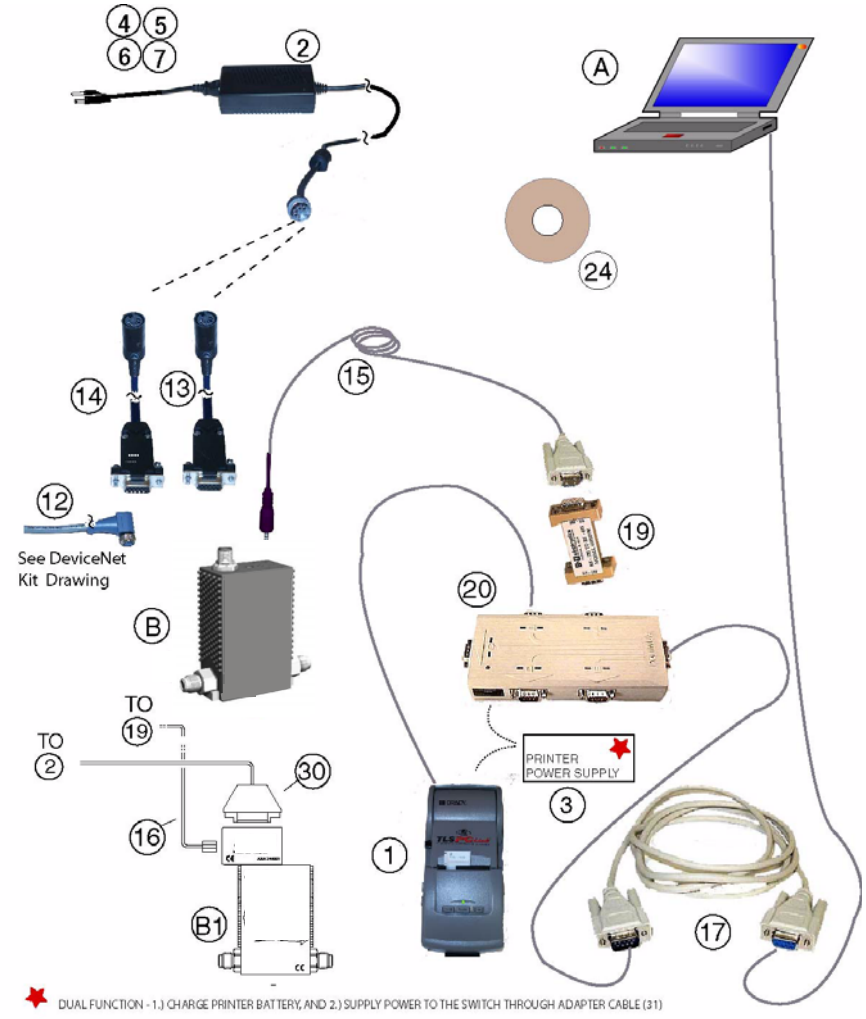


Figure 65: IN2 Field Kit A332293001

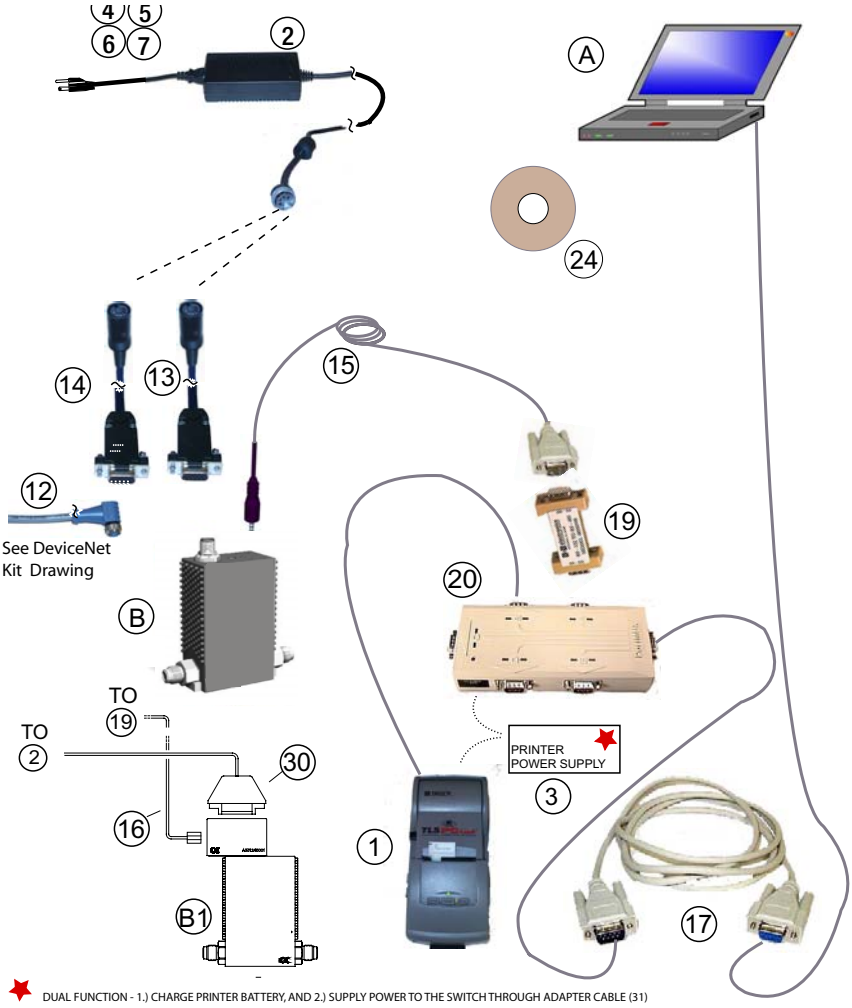


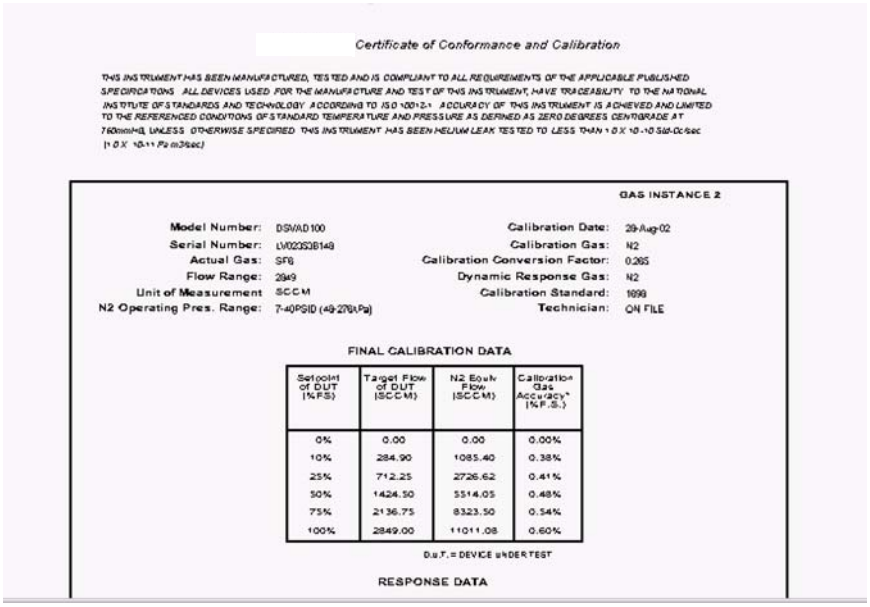
Figure 66: DeviceNet Field Kit

Table 21: FIELD KIT A33229300x PARTS BREAKDOWN

ITEM	ITEM DESCRIPTION	PART NUM-	Kit Number -
1	Printer	A332294001	1
2	Power Supply, MFC	A332295001	1
3	Power Supply, Printer	A332352001	1
4	Power Cable, North America	ME02381690	1
5	Power Cable, Japan	A332296001	1
6	Cordset, w/C13 10 Amp, European	A332353001	1
7	Cordset, 5 Amp w/C13 Con, U.K./Ireland	A332354001	1
8	Cordset, 2.5 Amp Class 2 w/C7 Con, North	A332355001	1
9	Cordset, 3 Amp Class 2 w/C7 Con, Japan	A332356001	1
10	Cordset, 2.5 Amp Class 2 w/C7 Con, European	A332357001	1
11	Cordset, 2.5 Amp Class 2 w/C7 Con, U.K./Ireland	A332358001	1
12	Cable, Power Adapter, DeviceNet	A332297001	1
13	Cable, Power Adapter, 9 Pin	A332297002	1
14	Cable, Power Adapter, 15 Pin	A332297003	1

ITEM	ITEM DESCRIPTION	PART NUM-	Kit Number -
15	Cable, DB9 to 2.5mm	A331710003	1, 2
16	Cable, DB9 Male to RJ-11	A332292001	1, 2
17	DB9, Male/Female Extension Cable - 6ft	A332298001	1, 2
18	PC Cable, Printer (not shown)	A332299001	1
19	Port Powered RS-232/RS-485 Converter	A332300001	1
20	Switch, Expandable, Smart 5 Port	A332359001	1
21	Battery, Printer	A332301001	3
22	Cartridge, Ribbon	A332360001	3
23	Labels, Printer	A332361001	1, 3
24	IN2 User Software	A332289001	1, 2
26	Cable, Communications, DeviceNet to DB9	A332362001	4
27	Card, PCMCIA DeviceNet	A332363001	4
28	Junction, VB2	A332364001	4
29	Cable, PCMCIA	A332365001	4
30	Cable, Card Edge Power Adapter	A332366001	1
31	Adapter, DC, Smart Switch (not shown)	A332384001	1
A	Personal Computer	User	1,2,4
B	IN2 MFC	Reference	1,2,4
B1	IN2 MFC with Electrical Adapter	Reference	1,2,4

CERTIFICATE OF CONFORMANCE AND CALIBRATION APPENDIX J



Certificate of Conformance and Calibration

THIS INSTRUMENT HAS BEEN MANUFACTURED, TESTED AND IS COMPLIANT TO ALL REQUIREMENTS OF THE APPLICABLE PUBLISHED SPECIFICATIONS. ALL DEVICES USED FOR THE MANUFACTURE AND TEST OF THIS INSTRUMENT, HAVE TRACEABILITY TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY. ACCORDING TO ISO 10012-1. ACCURACY OF THIS INSTRUMENT IS ACHIEVED AND LIMITED TO THE REFERENCED CONDITIONS OF STANDARD TEMPERATURE AND PRESSURE AS DEFINED AS ZERO DEGREES CENTIGRADE AT 760mmHG, UNLESS OTHERWISE SPECIFIED. THIS INSTRUMENT HAS BEEN HELIUM LEAK TESTED TO LESS THAN 1.0 X 10-10 Std-Cc/sec (1.0 X 10-11 Pa m3/sec)

GAS INSTANCE 2

Model Number:	DSMAD100	Calibration Date:	29-Aug-02
Serial Number:	LM022SSB149	Calibration Gas:	N2
Actual Gas:	SF6	Calibration Conversion Factor:	0.265
Flow Range:	2849	Dynamic Response Gas:	N2
Unit of Measurement	SCCM	Calibration Standard:	1699
N2 Operating Pres. Range:	7-40PSID (49-276kPa)	Technician:	ON FILE

FINAL CALIBRATION DATA

Setpoint of DUT (%FS)	Target Flow of DUT (SCCM)	N2 Equiv Flow (SCCM)	Calibration Gas Accuracy* (%F.S.)
0%	0.00	0.00	0.00%
10%	284.90	1085.40	0.38%
25%	712.25	2726.62	0.41%
50%	1424.50	5514.05	0.48%
75%	2136.75	8323.50	0.54%
100%	2849.00	11011.08	0.60%

D.u.T. = DEVICE UNDER TEST

RESPONSE DATA

Figure 67: Certificate of Conformance and Calibration Example

SERVICE AND RETURN INSTRUCTIONS APPENDIX K

Service Instructions

In response to your call, a qualified Technical Support Engineer will assist in diagnosing the IN2 MFC.

When contacting the Technical Support Group, please have available:

1. the serial number on the back of the IN2 MFC case,
2. the gas(es) that the IN2 MFC has been controlling, and
3. a description of the process system in which the IN2 MFC is installed.

If the Technical Support Engineer determines that the IN2 MFC requires servicing, you will be instructed to return the Digtal MFC to a specified Celerity Service Center; in addition you will be given a Global Customer Care (GCC) number. The GCC number will allow you to track the progress of your return until a resolution is achieved.

In order to protect our technical support staff, we **MUST** know all of the chemicals to which the IN2 MFC you are returning has been exposed. This information will help us determine if special handling is required to process your repair. As a result, you **MUST** complete and submit a Certificate of Decontamination when you return your IN2 MFC for service. **NOTE**: a copy of this form is provided in **Appendix F** of this manual. Place a copy of the completed Certificate of Decontamination on the outside of the shipping container and place the original inside the shipping container on **TOP** of the IN2 MFC you are returning.

- If you do not send all of the requested information, our response to your service request may be delayed.
- If you do not send the *Certificate of Decontamination*, your service request may be delayed or rejected.

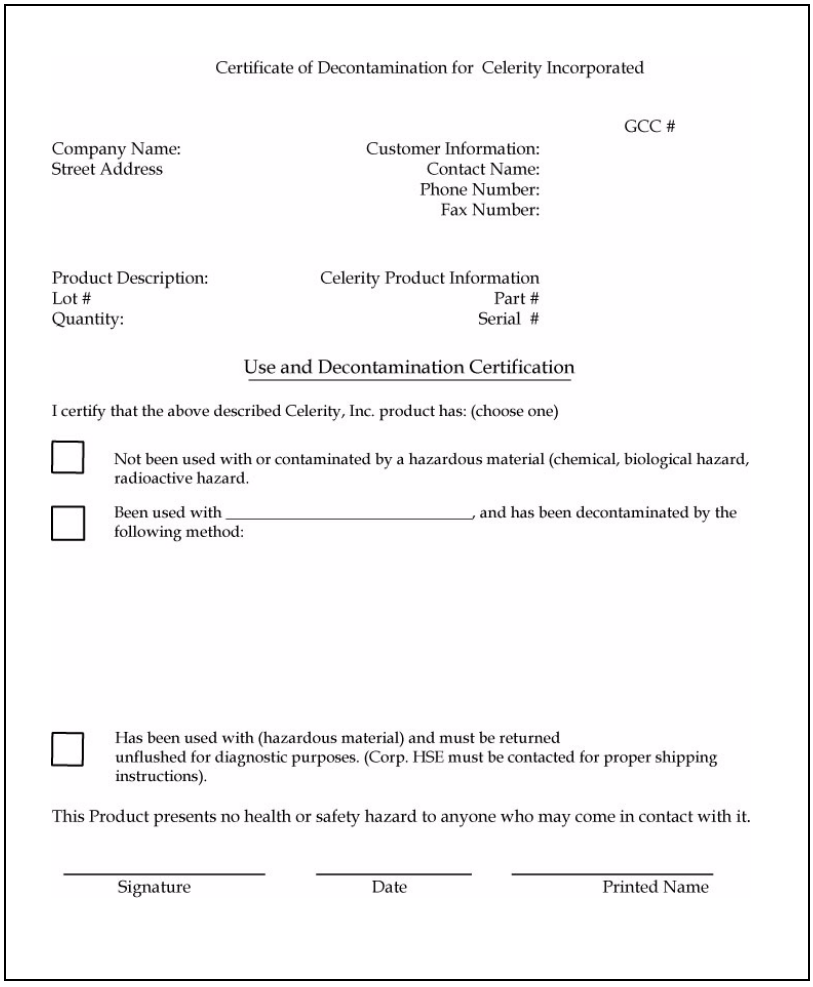
Return Instructions

If it is necessary to return the IN2 MFC please provide:

A disclosure of all chemicals exposed to the equipment enables us to protect our personnel and environment and to determine if special handling is required to process your repair. Therefore, a Certificate of Decontamination must be completed (See Figure 68). Please place a copy of the completed Certificate of Decontamination on the exterior of the shipping container and include the original on top of the product being returned.

- Omission of pertinent information may result in a delay in processing your order.
- Omission of the Certificate of Decontamination may result in either a delay or rejection of you service request.

For assistance in procedures or for ordering a Decontamination Letter, please contact Celerity Technical Support. Phone number are listed in the back of this manual.



Certificate of Decontamination for Celerity Incorporated

GCC #

Company Name:
Street Address

Customer Information:
Contact Name:
Phone Number:
Fax Number:

Product Description:
Lot #
Quantity:

Celerity Product Information
Part #
Serial #

Use and Decontamination Certification

I certify that the above described Celerity, Inc. product has: (choose one)

☐ Not been used with or contaminated by a hazardous material (chemical, biological hazard, radioactive hazard.

☐ Been used with _____, and has been decontaminated by the following method:

☐ Has been used with (hazardous material) and must be returned unflushed for diagnostic purposes. (Corp. HSE must be contacted for proper shipping instructions).

This Product presents no health or safety hazard to anyone who may come in contact with it.

Signature _____ Date _____ Printed Name _____

Figure 68: Decontamination Letter Example

7.0

Product warranty information can be found on our Celerity website at www.Celerity.net. This information provides general warranty information, limitations, disclaimers, and applicable warranty periods according to product group.

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Allen, TX 75013 USA
Telephone 972.359.4000
Facsimile 972.359.4100
www.celerity.net

For technical assistance, contact Celerity Technical Support at 972.359.4000.

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